

AUTOMOTIVE *and Aviation* INDUSTRIES

JANUARY 15, 1943

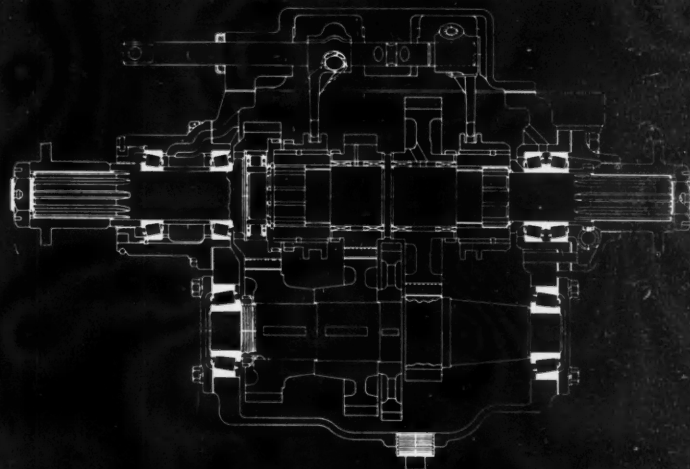
TIMKEN BEARINGS HAVE BEEN USED FOR 22 YEARS IN THIS BROWN-LIPE AUXILIARY TRANSMISSION MANUFACTURED BY SPICER

Usually used to give better traction by having ratios available to meet each condition, auxiliary transmissions naturally have extremely high gear loads and consequently heavy bearing loads. Here's why Spicer selected Timken Bearings and why bearing performance in their units has been so dependable.

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AUTOMOTIVE and Aviation INDUSTRIES

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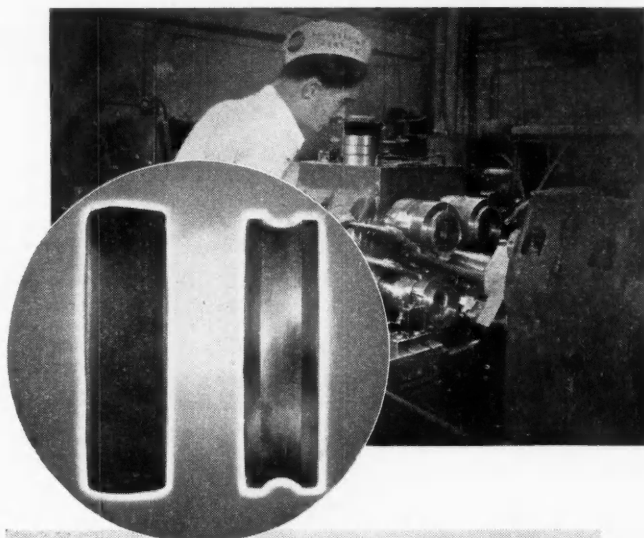
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January 15, 1943

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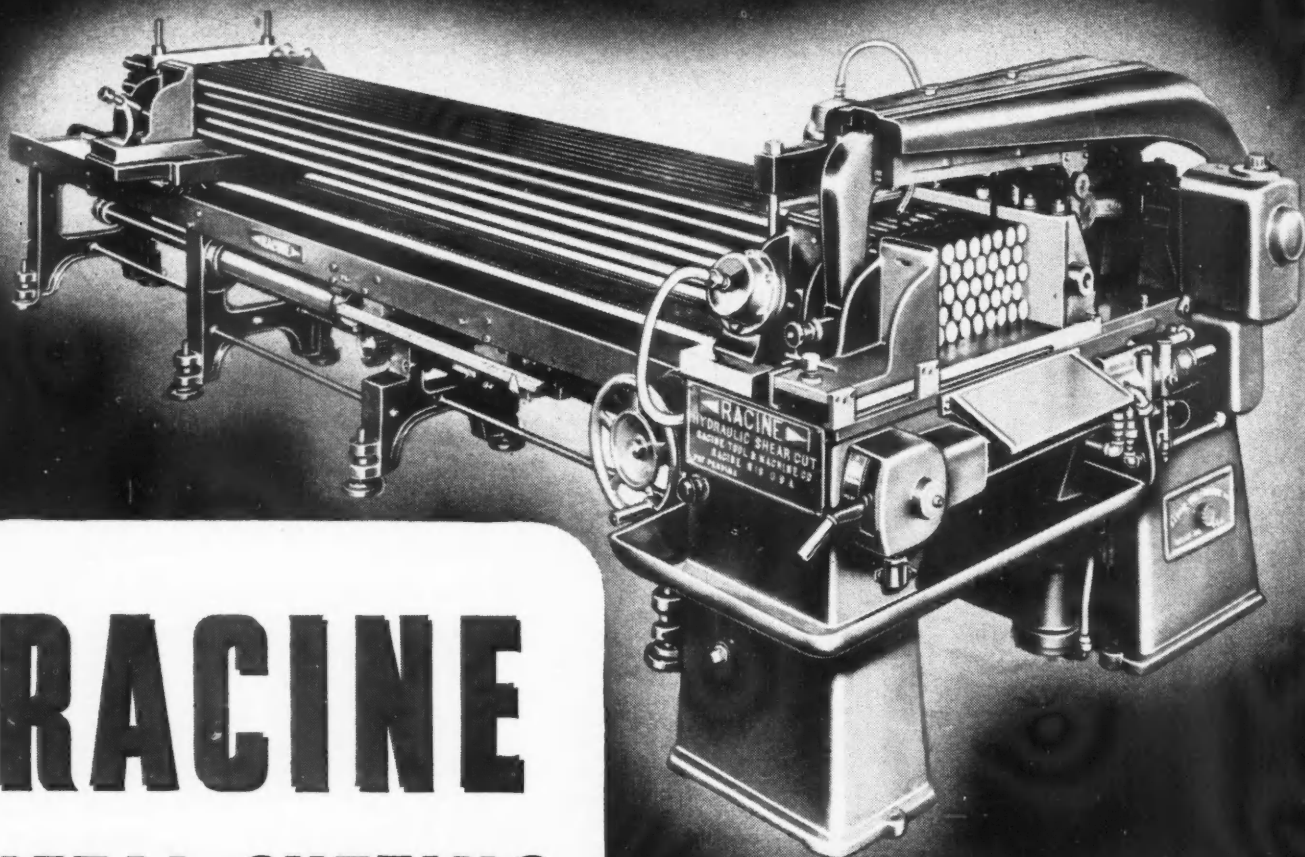
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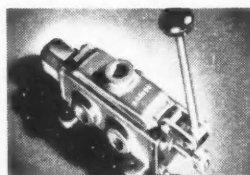
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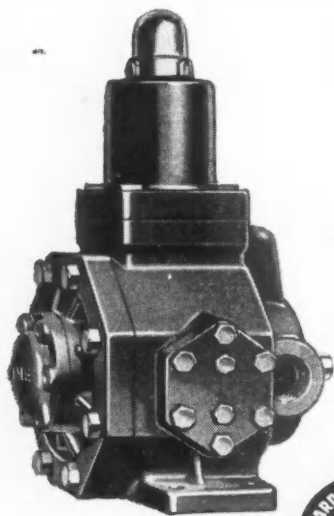
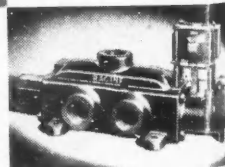
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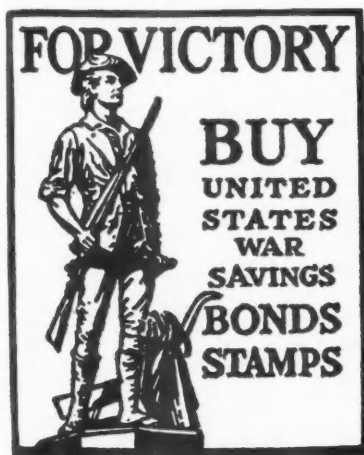
AUTOMOTIVE INDUSTRIES

Reg. U. S. Pat. Off.

More Wood Bodies

Under the Army's new policy of specifying wood bodies for military cargo trucks, more than a thousand small firms will be brought into the manufacturing program, according to the Tank-Automotive Center of the Ordnance Dept. at Detroit. The program of substituting wood for steel in these bodies went into effect in September and it is estimated that it will save 460,000 tons of steel based on present cargo truck requirements of the Army.

Thirty-seven small firms, which previously had received educational orders, will serve as the prime contractors under the wood cargo body procurement program. They will employ more than a thousand subcontractors, including 330 sawmills. Spreading of these prime and subcontractors over a great geographical area and their proximity to sources of rough lumber were considered in allocating the orders. This will cut down considerably on the distance that the pre-cut dimensional lumber must be shipped, effecting a saving in shipping facilities.



January 15, 1943

One-Piece Hollow Steel Propeller Blades

18

At the American Propeller plant they are making propellers from a single piece of alloy-steel tubing. The accuracy of the blades is carried to a degree that makes them interchangeable. They can be used for replacements without any adjusting. The technique of their manufacture is quite a story and you should read it.

Freight Transport by Air in Latin America

24

Carrying heavy cargoes from point to point in the Central American countries is coming to the forefront with great strides. Both from the viewpoint of cost and that of time it tops all other means. They are learning a lot in how to do it. That makes informative reading.

Curtiss Caravan C-76 Transport

26

Built almost wholly of non-strategic materials this new design of the Curtiss-Wright Corp. is of particular interest.

Adel's Training System

30

In trying to keep up with the war production program most makers of war materials have been obliged to train a great part of their personnel for the needs of the new jobs. At the Adel Precision Products Corp. a system of teaching has been evolved that is somewhat out of the ordinary. It works so well that not to read this article would be regrettable.

Rolls-Royce Merlin "61"

34

Here are some drawings and data on a new engine that has some brand new features and is capable of service that previous models could not match. Turn now to page 34.

Short Cuts

36

The Short Cuts that have appeared in previous issues have created so much interest that another offering is being made. You know their value, so read them.

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...with Assurance



Jominy End-Quench Hardenability Testing in Ryerson Lab. All NE Alloy Steels are tested before they are accepted for stock and check tests are conducted to assure accuracy of results. This data is passed on to customers with each shipment.

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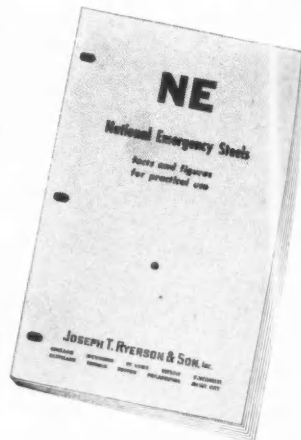
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AUTOMOTIVE and AVIATION INDUSTRIES

Published on the 1st
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Vol. 88, No. 2
January 15, 1943

The World's **Biggest** **Inventory of Machine Tools** **'s Bigger Now**

By E. L. Warner, Jr.

As 1943 gets under way and the United States goes forward in its second year of war, the automotive industry is better than 75 per cent tooled up for its huge war production tasks. Some plants remain to be tooled, but these are mostly in the aircraft classification and their machinery and equipment is expected to be installed during 1943.

General Motors Corp., the largest company in the industry, listed 112,407 machine tools in its more than 100 plants as of the end of December. Of this total, 82,791 machine tools are owned by the corporation, 27,061 by the Defense Plant Corp. and other federal agencies, 1900 by the British Purchasing Commission, and 649 on consignment from other contractors. Since the national defense program was inaugurated in June, 1940, General Motors has ordered 49,087 new machine tools. Up to the end of December, 37,878 of these machines had been received, or approximately 77 per cent of the total, leaving 11,209 units for delivery in 1943 or later.

GM has 19,590 machine tools for which no use has been found in the war effort. This is approximately 25 per cent of the corporation's peacetime machine tool inventory. Many of these are special-purpose machines for automotive manufacturing which are unsuitable for war assignments. GM has sold 1460 machines to other companies and 846 to Government agencies for war work. Four hundred and twenty-two machines have been consigned to subcontractors. A total of 2766 machine tools have been transferred between GM divisions and plants for war contracts through a central clearing house at Detroit.

Commenting on the prospects for further tooling in 1943, Charles E. Wilson, GM president, said recently, "I think it will be a normal business instead of a hectic one. It will be possible to make some changes that will require some retooling in order to make things better or to produce them more efficiently and

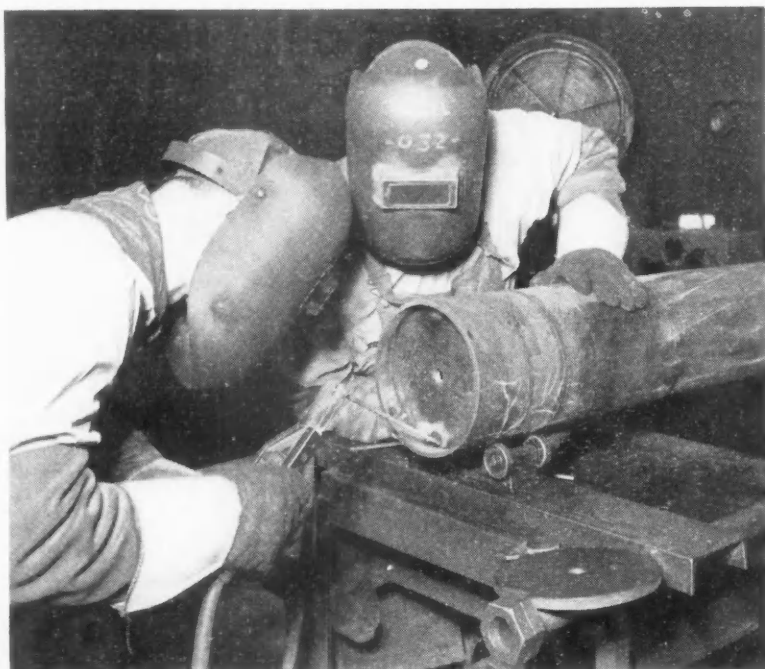
to save manpower in production. So there will be some retooling for improved production and improved quality. Then there will be some new military projects. . . . I am rather expecting that we won't have much additional expansion, that it will be mostly a question of going back over the things we have and trying to make them better for military purposes and setting up more efficiently for production."

Chrysler Corp., which is filling war contracts in 24 main plants, anticipates an ultimate total of 30,000 machine tools on such work. Of this total, 15,000 machines have been taken from peacetime manufacturing operations. About 8000 of the 15,000 new machine tools ordered have been received. The corporation has 5000 machines which are not adaptable for war jobs, although some of these have been shipped to other war contractors. The huge Dodge-Chicago aircraft engine plant alone will require nearly 6000 machines, of which only the first few units have been installed so far.

Ford Motor Co. had to install more than 90 per cent new machinery in its new aircraft engine plant and 85 per cent new machines in the Willow Run bomber plant. However, Ford engineers were able to convert 200 automotive presses for the fabrication of bomber airframe parts. For the manufacture of medium tanks about 50 per cent of the machinery came from automotive lines. On the aircraft engine and bomber contracts, more than 4000 machine tools had to be ordered. Other new equipment was required for the manufacture of turbo-superchargers and transport gliders. Tank engine, army truck and jeep manufacturers were able to utilize a great amount of automotive production machinery and assembly lines.

Packard Motor Car Co., one of the largest producers of high output engines in the war effort, has 6900 machine tools engaged in war work. Twenty-five hundred of these came from automotive production lines. Pack-

(Turn to page 78, please)



Before flattening operations, tube is sealed by welding a header in one end and a connection on the swaged end, to provide internal gas and oil pressure.

One-Piece,

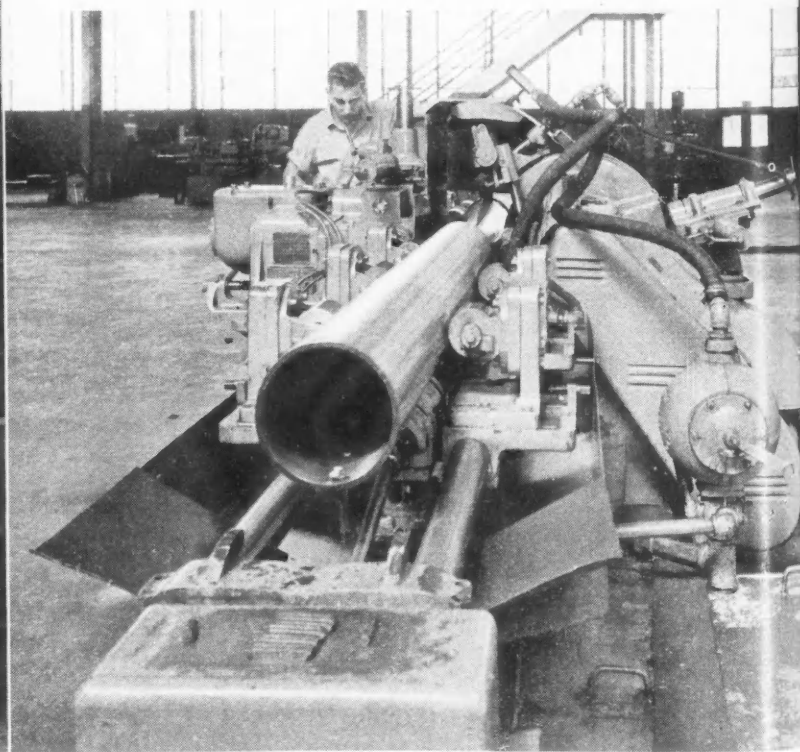
By
Joseph
Geschelin

MUCH of the romance of scientific achievement is usually buried under a mass of detail and, consequently, is obscured from the view of the casual observer. It is, therefore, a pleasure to present through the courtesy of American Propeller Corp. a few of the highlights of the new art of producing one-piece hollow steel blades for the flying services.

When the observer notes the complexity of the process, and the flow of skillfully planned operations in all



(Left) To form the shank of the blade, the end of the tube is swaged in a 4000-ton press. By means of the horizontal attachment, the tube is rotated as it is fed into the swaging dies at each stroke of the press.



Hollow Steel Propeller Blades

produced at the American Propeller plant are interchangeable

their multiplicity, it is easy to understand why it is that the current activity stems from a technical development undertaken many years ago.

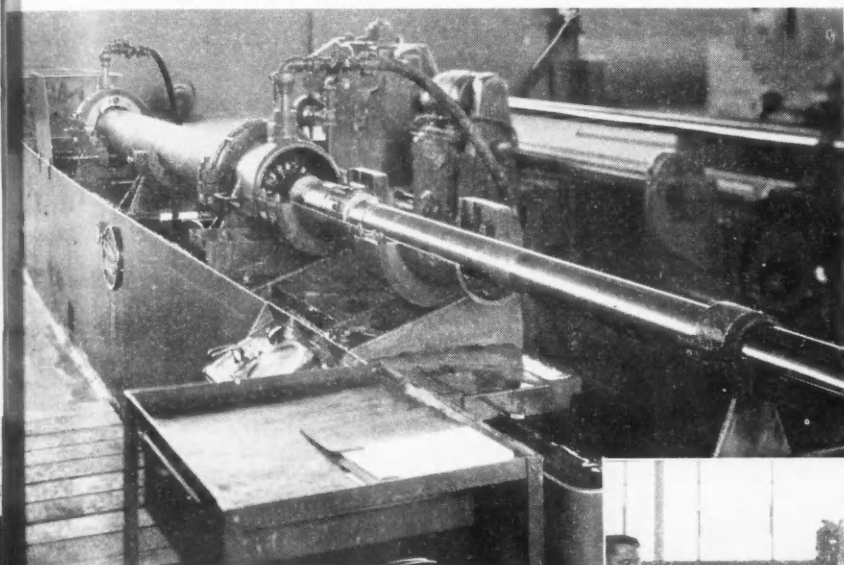
Hollow steel propeller blades made by American Propeller Corp. for the flying services offer a number of distinctive features both in design and in fabrication. From the standpoint of design, American blades are made of one piece—starting with a large diameter alloy steel tube. In the various stages of fabrication the wall thickness of the tubing is maintained within rigid limits at all critical sections

so as to obtain complete uniformity. This, in turn, makes it possible to achieve a positive uniformity of balance so that all production blades are indeed interchangeable.

Another element contributing to uniqueness of construction is that welding is held to the minimum, the seam-welding operations being performed on electric resistance welding machines.

The American Propeller plant is new, of the most modern design, built specifically for the mass-production of propeller blades. It may be noted, too, that the machinery and other equipment are of the latest design, featuring huge presses; a battery of large lathes, long horizontal honing machines; large centerless grinders, cylindrical grinders, and milling machine; internal grinders; a battery of forging machines served by a special induction heating machine, etc.

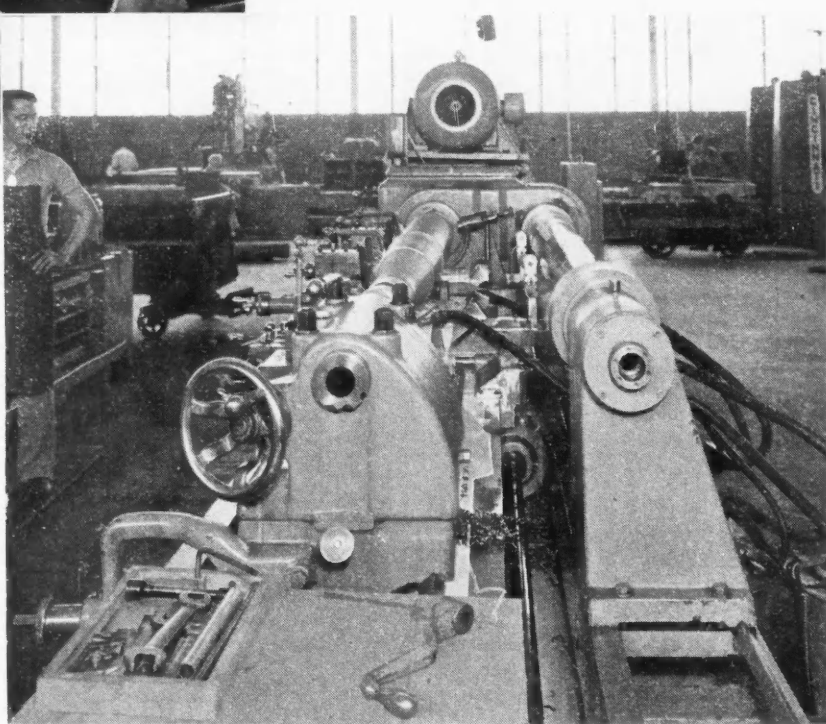
In addition to the blade fabricating facilities there is a self-contained automatic department developed for the production of a unique balancing device which is instrumental in achieving uni-

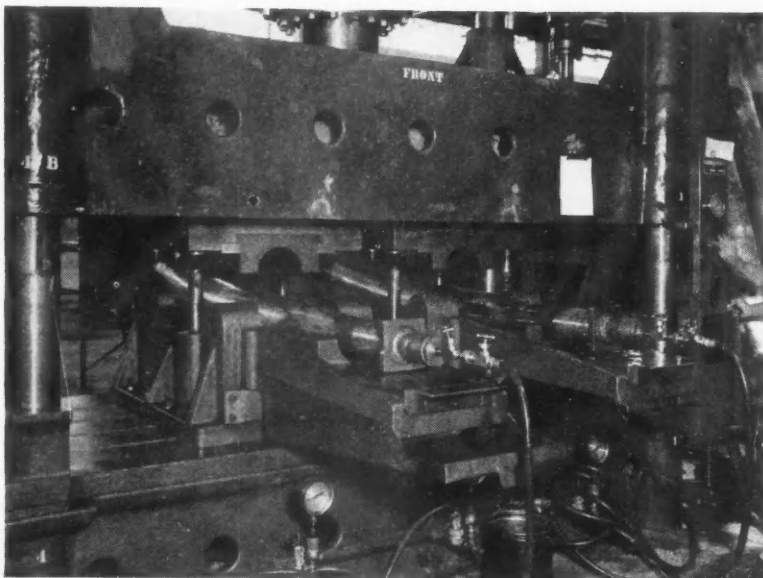


(Above) First machining operation after annealing the steel tube is honing the inside diameter to remove surface imperfections. Machines are specially designed.

(Right) Proper wall thickness, tapering from the swaged end, is obtained by turning in a lathe, using a master cam and follower. The cam is shown at the right, the partially turned tube at the left.

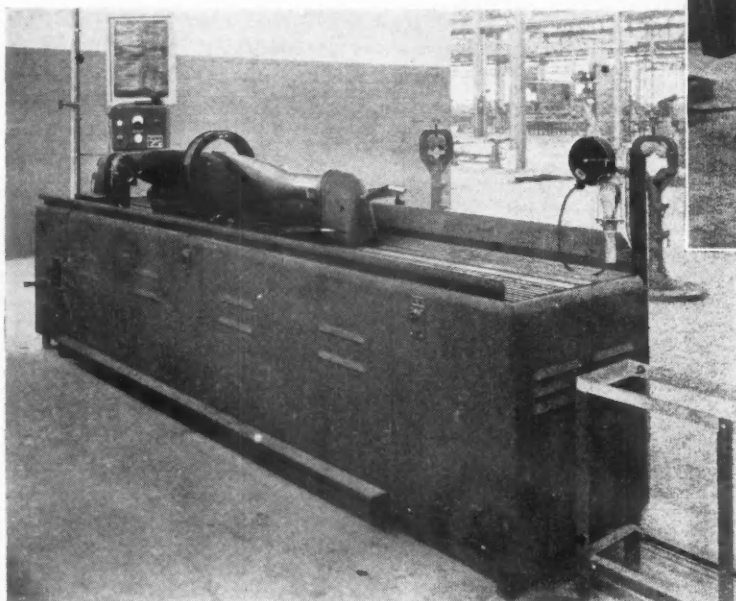
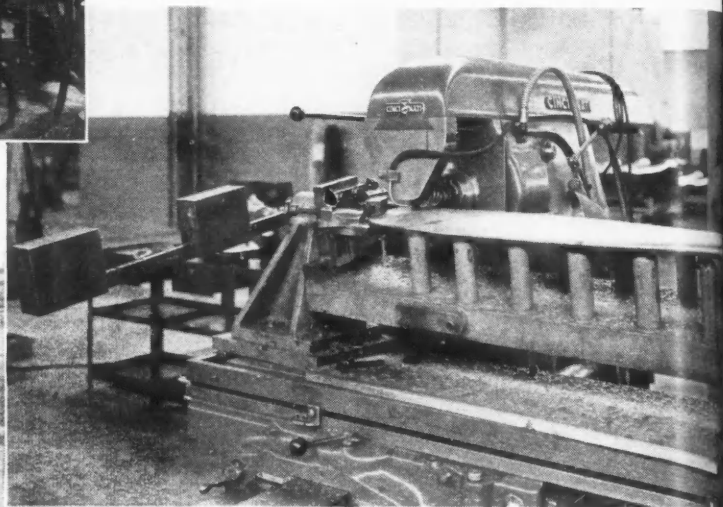
(Left) Outside diameter of the tube is ground on Centerless Grinder to provide uniform wall thickness.





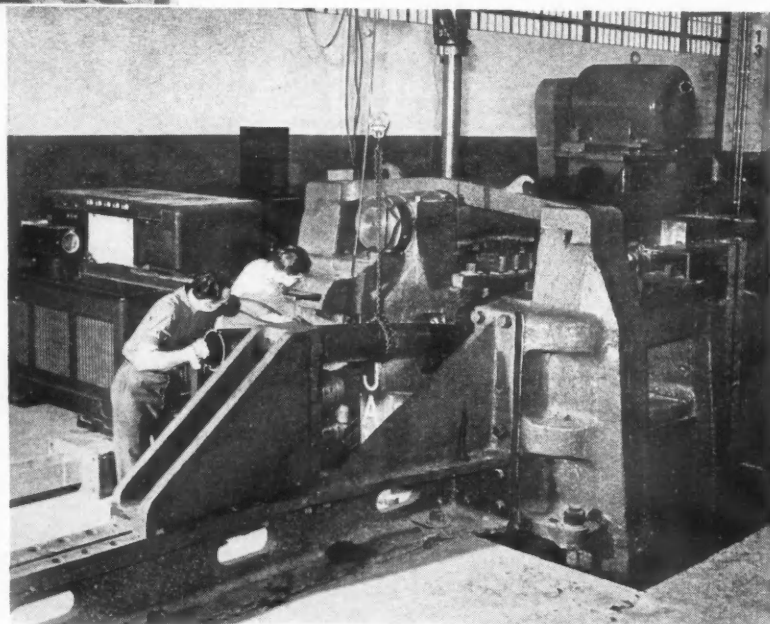
(Left) Tubes are being bent in hydraulic presses. View shows connections in end of tube to provide constant internal liquid pressure.

(Below) Trailing edge and tip of blade are machined in this miller, fitted with a special fixture.



(Left) The blade is carefully checked on a magnetic machine for structural flaws. It is Magna-fluxed at least four times at different stages as well as after the blade is completely machined.

(Below) The swaged end is gathered and upset in an upsetter. Before upsetting, the swaged end of the tube is heated in the electric induction unit shown at the left.



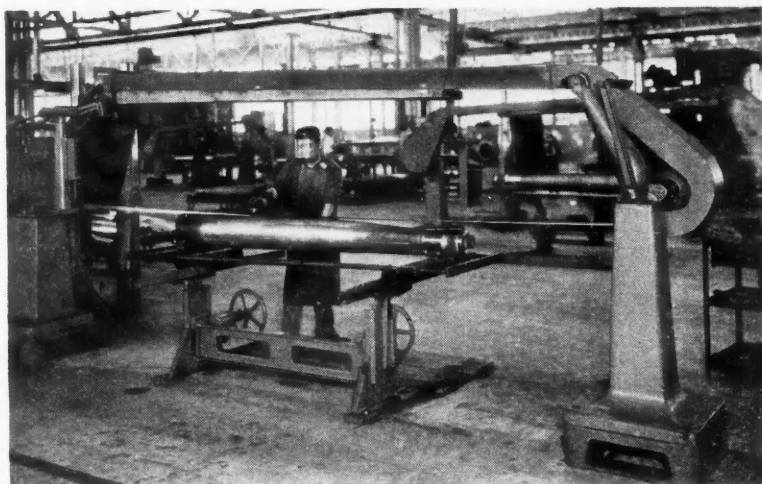
formity of balance for the propeller blade.

As will be evident later, heat treating is one of the major phases of the production process. For this purpose there are installed the latest electric pit type bell furnaces and rotary furnaces for heat treating and normalizing.

Magnetic inspection equipment is used at various critical stages of the operation. All welding operations are subjected to X-ray examination, this being a 100 per cent procedure.

A feature of the plant is the use of the power distribution duct system which simplifies the power connections to all machinery, makes it pos-

The tube is polished on a belt sander, wall thickness at each station being held very closely. To accomplish this, the tube is chalk marked, using a cage type template and the tube marked at the various stations, indicating the amount of metal to be removed.



Flattened tube is shown being inserted in press for preforming and die - quenching. The blade is finally formed in the same type of press.



The rough ends of the blade then are sawed off in preparation for upsetting of the shank end. The shank end is heated in an induction heating machine, gathered and upset in a massive upsetter. Following this, the shank is air-cooled while immersed in a bed of powdered mica.

One of the major features of the fabrication process is the use of a large, solid steel arbor fitted into the swaged tube to maintain straightness and alignment during the machining stages. The tube is turned and bored on the shank end in turret lathes in preparation for fitting of the arbor. Then the tube is heated and the arbor shrunk. The tube and arbor assembly now are placed in a fixture in an 800-ton Hydraulic press for straightening in preparation for succeeding machining stages.

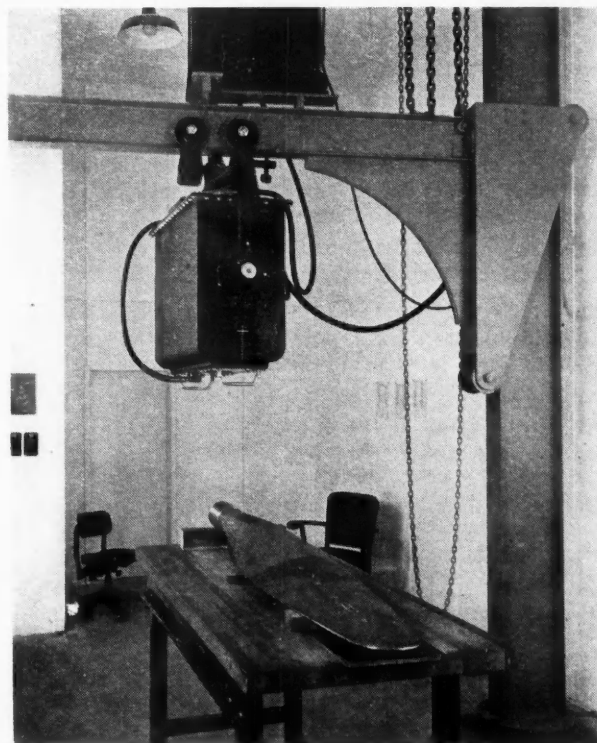
The critical step of cam-turning of the O.D. so as

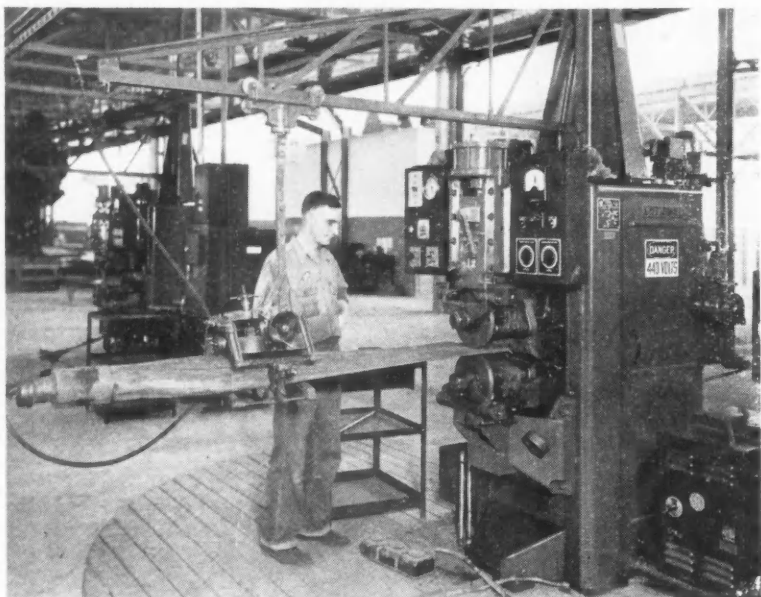
sible to rearrange such equipment at will. Materials handling also has been skillfully developed, employing various types of monorail conveyor systems, and electric hoists.

Looking to the future, the plant is laid out with equipment of similar character in two parallel lines so as to permit the fabrication of blades of different sizes. The blade begins with a seamless alloy steel tube, suitably annealed. First machining operation is that of honing the bore on a huge horizontal honing machine, fitted with an adjustable hone. This has the function of polishing the inside diameter and of removing surface imperfections.

Next the O.D. is rough-turned on lathes, then finished on specially designed centerless grinders. The tube is now ready for swaging of one end to form the shank. This is done in a 4000-ton mechanical press fitted with a special horizontal feeding attachment. The latter rotates the tube while feeding it into the swaging die at each stroke of the press. Coordination of the press and feeding mechanism functions is effected by an electrical controller attachment.

Blades are X-rayed twice during process of manufacture.





Preformed tube is seam-welded in welding machine along scribed line at tip and portion of trailing edge. The blade is later again sheared to remove extra metal on tip and trailing edge.

to obtain the proper wall thickness of the tubing, tapering from the swaged end, is handled in special two-spindle lathes. One spindle carries a master tube or cam, the master profile being transferred to the production tube by means of a hydraulic follower which controls the movement of the tool blocks.

Upon completion of cam-turning, the tube is heated so as to facilitate removal of the arbor. It is then sand-blasted and the scale on the inside removed by means of a belt sander.

The tube now proceeds to the polishing department where it is then sanded to size on special belt sanders, and magnetically inspected.

We are now ready for the next major issue—that of blade forming. To this end, the tube is sealed at both ends by welding a header in the large end and a connection in the swaged end. These operations are performed by arc-welding. Following this, a square locating block is fastened to the shank end to provide a means for locating the trailing and leading edges while in the bending dies.

The tube is bent in hydraulic presses, handling two tubes at a time. During this operation the interior of the tube is held at a constant pressure. The tube is then flattened in another press. After flattening, the flared end is heated in an induction heating unit, and sheared off in a press.

Next step is that of closing the open end by seam welding, sealing the joint by arc-welding and also welding on the locator for positioning in the next press

die. The tube is now heated in a pit-type rotary furnace, scaling of the I.D. being inhibited by filling the interior with a neutral gas under pressure, then flattening and die-quenched in a large hydraulic press.

The flattened tube is ready for its final stages. The blade tip contour is sealed by seam-welding. Excess metal around the seam weld then is sheared off in a press. Following this, the exposed edge is sealed by oxy-acetylene welding.

Experience has indicated the desirability of providing accurately controlled fillets. This is accomplished with an ingenious brazing procedure in which

copper fillets are brazed in both the leading and trailing edges.

X-ray examination of the blade is made twice—once after welding of the tip and trailing edge, and again after brazing. The X-ray plates for each blade are carefully examined by men and women laboratory technicians and are kept on file for reference by the Army Air Force inspectors.

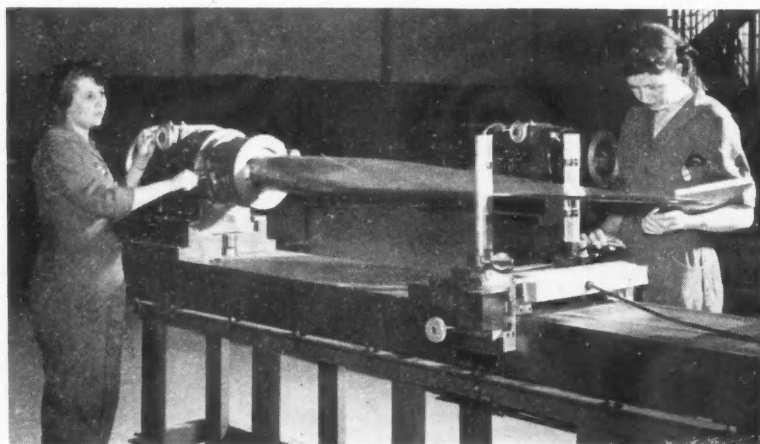
Next come some of the major heat treating operations. The blades are normalized, then heat treated, die-quenched in a hydraulic press, drawn, then sand-blasted.

We now approach the final phases of blade manufacture. First, each blade is inspected and marked with a center line. Then the trailing edge and blade tip are milled to proper thickness, on milling machines, fitted with special automatically positioning fixtures. This is followed by the first of the balancing operations, the blade being polished for the first correction, then magnetically inspected.

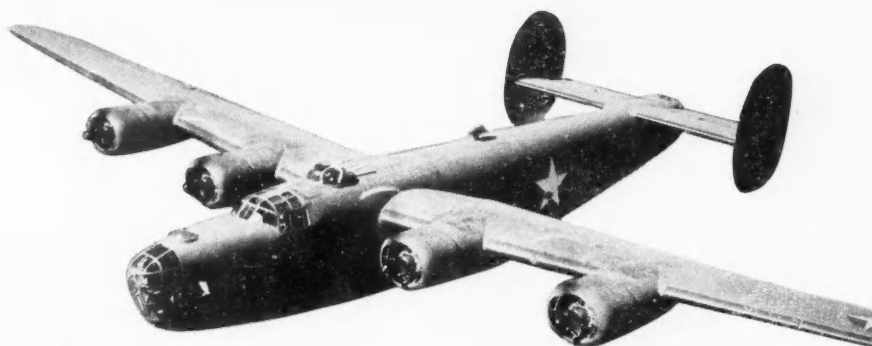
The next balancing operation makes the correction for boring the shank end, and this is followed by another balancing operation with a suitable correc-

(Turn to page 70, please)

Blade is carefully checked dimensionally in the Inspection Department. Many women are used in the Inspection Department for similar operations. All blades are carefully balanced to the same horizontal moment and all have approximately the same weight so that the blades are entirely interchangeable with one another.



Heavy Bombers



The Consolidated B-24D Liberator has a lengthened nose section, the top turret is farther forward, and the engine cowlings are elliptical. The C-87 transport version of this Liberator bomber is being built by Consolidated at Fort Worth, Texas. Modifications include an unglazed nose, removal of the gun turrets, windows in the sides of the fuselage where the bomb bays were located, and a navigator's hatch on the top fuselage deck.

DATA for the American, British and German heavy bombers listed in the accompanying table have been compiled from material published in Great Britain, the performance figures for the American warplanes, except the range, being taken from the Lille bombing operation over France in October while the data for the British bombers are design specifications. The Heinkel He 177 data were obtained from a bomber of that type captured recently by the British.

Of particular interest is that the American and British bombers are better suited for different military missions, the former for use as a day bomber and the latter as a night bomber. Their engines equipped with turbo-superchargers, the Flying Fortresses and Liberators operate at high altitudes that make them difficult targets for enemy fighters and anti-aircraft batteries on the ground, but in addition they are heavily armed for defense. The Boeing Flying Fortress (B-17F) is equipped with 13 machine guns, 12 of .50-cal and one of .303-cal. The Liberator (B-24D) has nine .50-cal. guns.

On the other hand, the British Lancaster, Stirlings and Halifaxes can carry heavier bomb loads, but operate at lower altitudes and have lighter armament than

the American bombers. British tacticians still stick to the .303-cal. machine guns for defense, 10 on the Lancaster and eight apiece on the Stirling and Halifax. The tabulated bomb loads of the British bombers are the maximum with partly filled fuel tanks, so for long

American, British and German Heavy Bombers

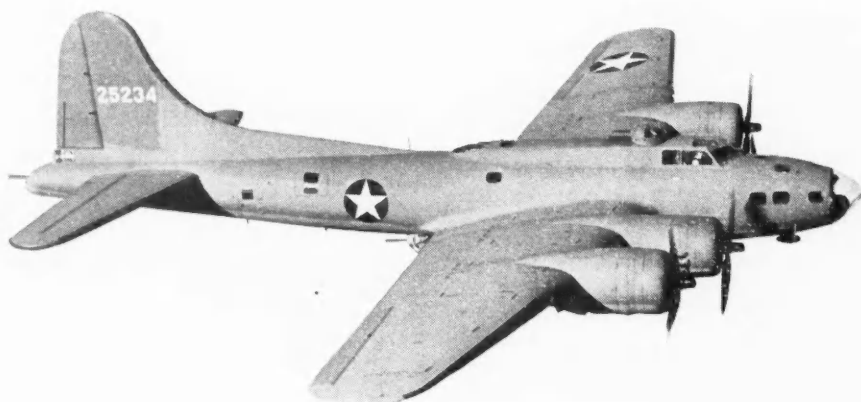
	Boeing Flying Fortress	Consolidated Liberator	Avro Lancaster	Handley Page Halifax	Short Stirling	Heinkel He 177	Focke-Wulf FW200K2
Span (ft).....	103.8	110	102	98.8	99.1	103.3	108.5
Wing Area (sq ft).....	1486	1050	1297	1250	1460	1660	1290
Weight-Empty (lb).....	33,000	32,000	35,000	36,000	46,000	35,000	28,700
Weight-Loaded (lb).....	55,000	52,000	60,000(63,000*)	60,000(62,000*)	70,000	71,600(82,000*)	48,500
Bomb Load (lb).....	5000	6000	18,000 (max.)	13,000 (max.)	17,000 (max.)	10,000	3300
Maximum Speed (mph).....	290	280	300	300	280	280	280
Operating Height (ft).....	30,000	30,000	over 20,000	23,000
Maximum Range (miles).....	3500	3000	3000	3000	2050	7040	2430
Engines (No.-Hp).....	4-1200	4-1200	4-1280†	4-1280	4-1600	2-2300	4-1320

* Maximum overload.

† Alternate engines rated at 1600 hp.

range raids their bomb loads are reduced correspondingly. The Lancaster fuel tanks have a maximum capacity of nearly 2700 gal.

These heavy bombers also offer possibilities for conversion to cargo carriers. Already the Liberator design has been changed and the transport version (C-87) placed in production for the Army Air Forces. This new Consolidated transport has a cargo capacity in excess of 10 tons, a speed of approximately 300 mph and a range of nearly 4000 miles.



The B-17F, eighth model in the line of Boeing Flying Fortresses, incorporates over 400 design changes, mostly improvements in internal detail and amounting to 20 per cent new ship. Its plastic nose is larger and armament heavier than the E model equipment.

AIR transportation has developed to impressive proportions in Latin America, and air cargo has played an important part in its growth. The airline network is two-and-one-half times greater than that in the Continental U. S.; there are 44 operating companies with 750 scheduled stops, as compared with 18 air carriers in the U. S., with some 260 stops. However, owing to the low density of population, the intensity of operation over the Latin-American network is not very high. In 1940, for instance, the total mileage flown was only about one-fourth that of our domestic air lines, and the passenger traffic only about one-sixth.

The chief reason for the early and comparatively rapid development of air transportation in Latin America is the absence of improved roads and railroads, which in turn is explained by the fact that in nearly every one of the countries nature has placed serious obstacles in the way of surface transportation. In thirteen of the twenty republics the air routes already exceed the railroads in mileage.

Even on principal trade routes between capitals of neighboring countries, the airplane offers distinct advantages. For example, on the East Coast of South America, from Buenos Aires to Rio de Janeiro, surface travel requires six days, against seven hours by plane. From Rio inland to Asuncion, the neighboring capital of Paraguay, it is a 10-day round trip. By air it takes six hours. In a general way, the time of travel between the capitals of neighboring Latin-American countries, which heretofore has been from one to three weeks, has been cut to from one to three days by the airplane.

When one leaves the main trade routes, conditions are even more favorable to the airplane, because surface travel often is incredibly slow, irregular, uncomfortable and even dangerous, and the gross cost sometimes is even higher than the corresponding airline fare. An example is furnished by the 85-mile stretch between Cuenca, an important source of Panama hats, and Loja, an agricultural and textile center in Southern Ecuador, where a link of the Pan-American Highway is now being pushed to completion. The journey between the two towns takes five days by mule over a cold, wind-swept mountain trail with little or no

provision for over-night lodging. Mule hire alone is \$10, exclusive of shelter and food. Panagra makes the flight three times a week in 45 minutes and charges a fare of \$12. Even at a rate of 14½ cents per passenger-mile there is little competition from surface transportation.

An extreme example of the time saving made possible by the airplane is furnished by the Acre territory in the north-western corner of Brazil—a section purchased during the rubber-boom period from Bolivia by the then Brazilian foreign minister, Baron Rio Branco, because of its potential rubber resources. From this territory and adjoining sections of Peru and Bolivia came the finest grades of native rubber, known in the trade as the Upriver-Fine grade. From Rio Branco, at one end of the Acre territory, to Cruzeiro, at the other, is a four- to six-months' journey by canoe

Freight Transport

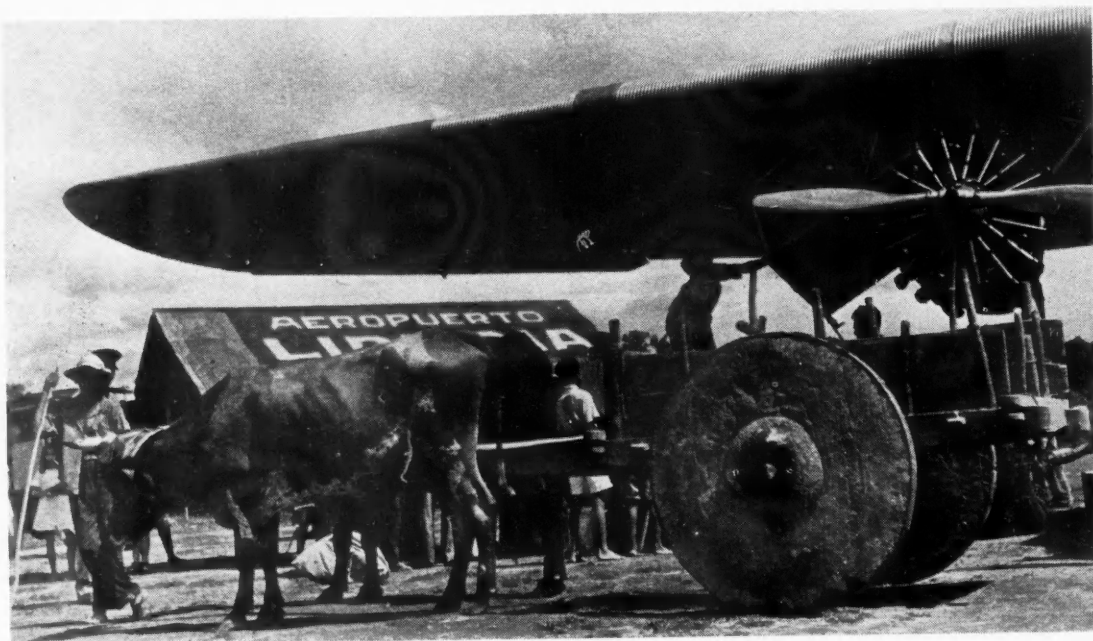
and balsa raft down the Rio Purus, along the Amazon, and back up the Rio Jurua. The airplane can make the trip comfortably in an hour and a half. Small wonder the Rubber Reserve Corporation in recent months has turned to aircraft as the most promising means of expediting rubber production throughout the Amazon basin.

In Central America the Transportes Aereos Centro-

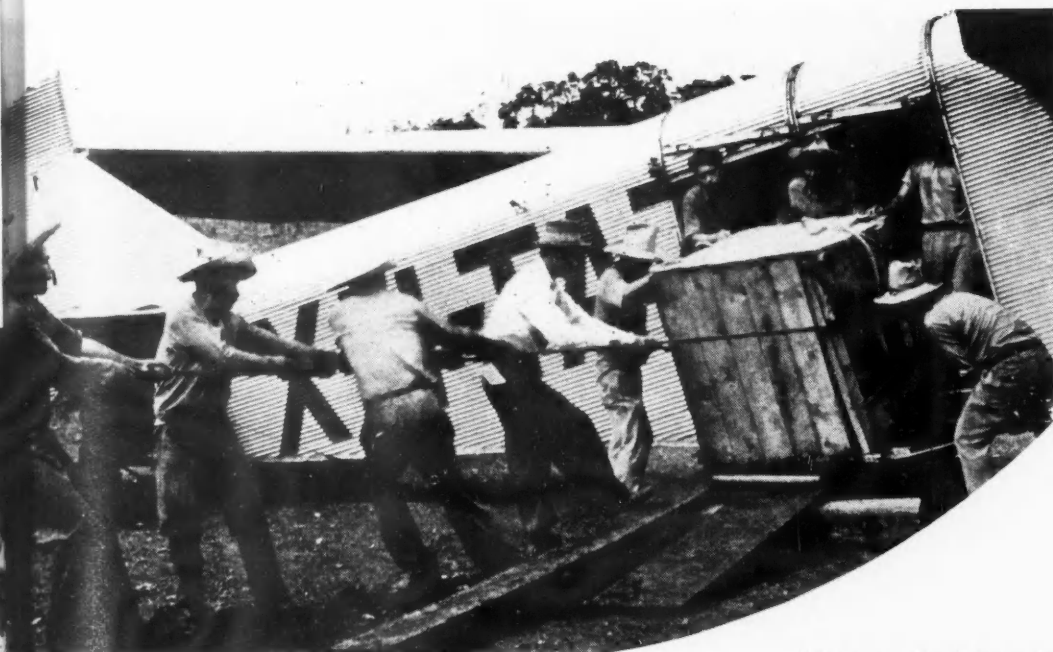


Small tractors are driven under their own power through the wide doors of a Taca freighter. This "Cat" tractor is one of half a dozen used by Taca for airport construction.

In Central America the oldest and newest modes of transportation operate together. A typical airport scene in the interior of Costa Rica, C.A.



by Air in Latin America



Unloading freight at a Taca jungle airport. Pieces such as this are far beyond the weight limit (200 lb.) that can be transported on mule back. Overland freight from Puerto Cabezas, Nicaragua port of entry for much of that country's mine freight, takes from four to six weeks. Taca makes the trip with 5000-lb loads in an hour.

Americanos, better known as "Taca," founded by Lowell Yerex, a New Zealander, has been the outstanding exponent of air freight transportation. Begun in 1931 with one small airplane, little financial resources.

**By
J. Parker
Van Zandt ***

Director, Office of Air
Transport Information,
U. S. Dept. of Commerce

and no government subsidy, the company has grown in the short space of eight years into an international transportation system of first importance to the several republics north of the Canal.

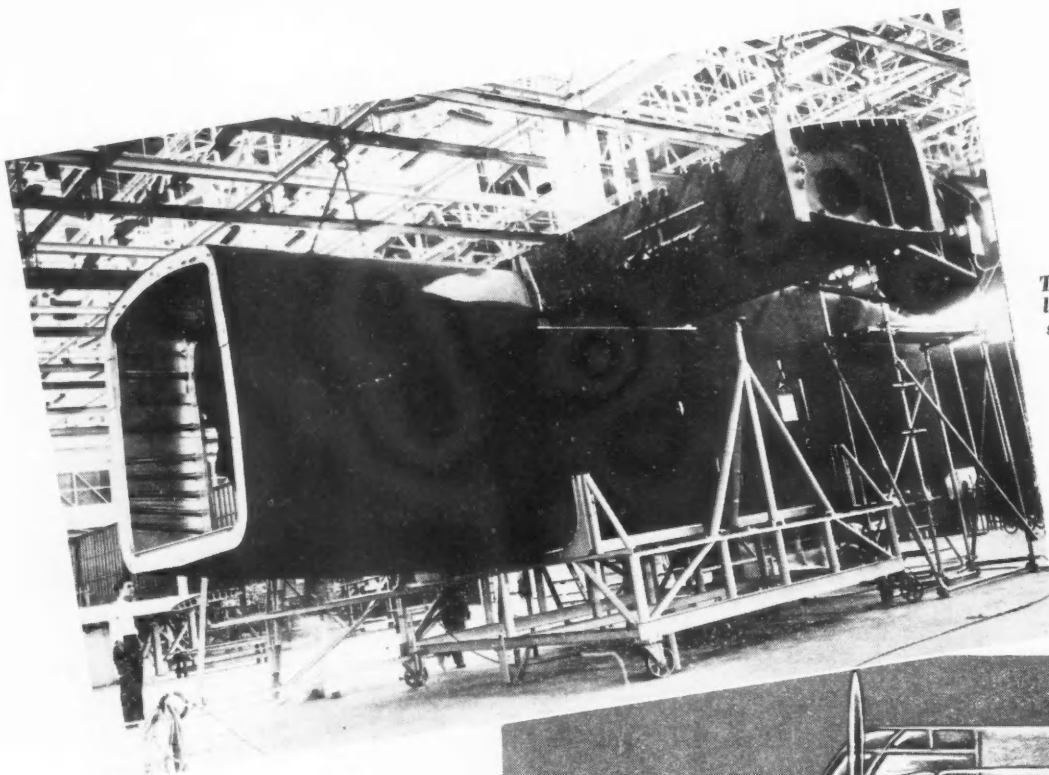
At the close of 1940 Taca operated into 236 landing fields, of which

85 were scheduled airports and the remaining 151 located at points to which the company offered charter or flag-stop facilities. The flight equipment in the spring of 1941 consisted of 50 planes, of which 26 were Ford trimotors and five were Lockheed 14's. Modern and extensive maintenance shops are maintained at Tegucigalpa, Honduras, and at San Jose, Costa Rica.

Taca's income has been derived primarily from freight. During 1940, for example, over 60 per cent of its total revenues came from this source, as compared with less than 3 per cent earned by the U. S.

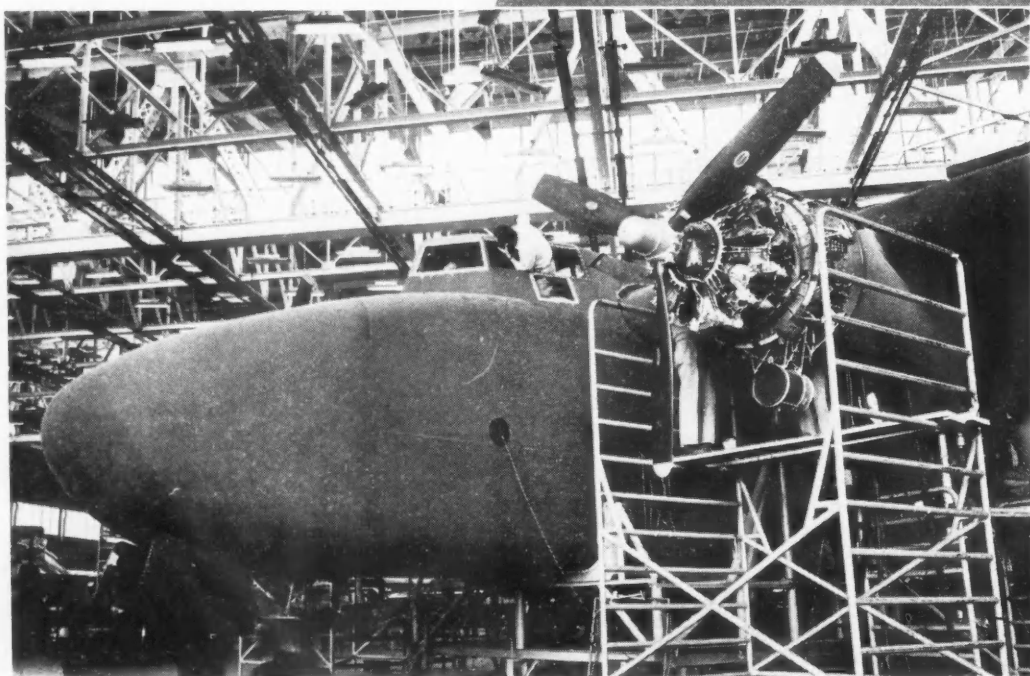
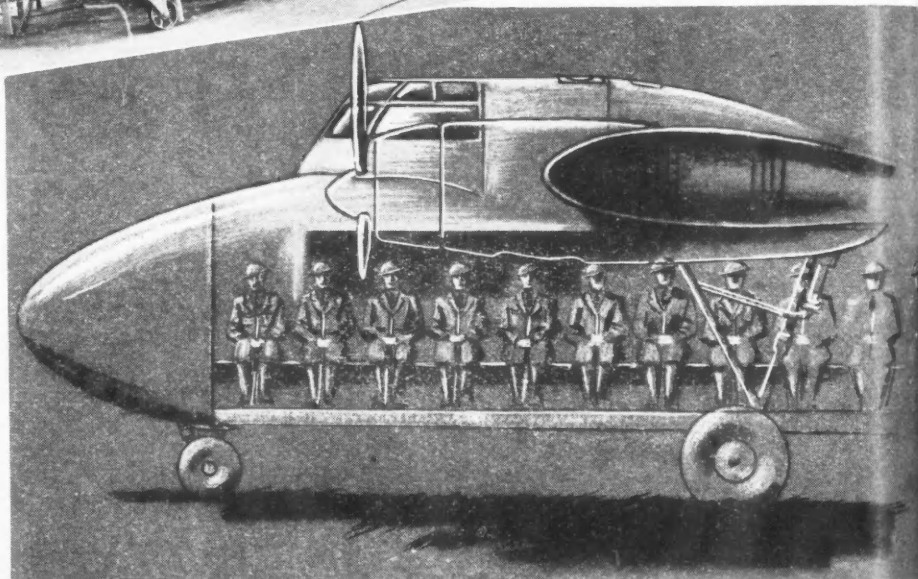
* This article is an abstract of a paper presented Dec. 8 by Mr. Van Zandt at the S.A.E. Air Cargo Engineering Meeting in Chicago.

(Turn to page 84, please)



The box-shaped fuselage and wing center section as they are being assembled.

Paratroops accommodations are provided in the forward section, above which is the control compartment for the crew.



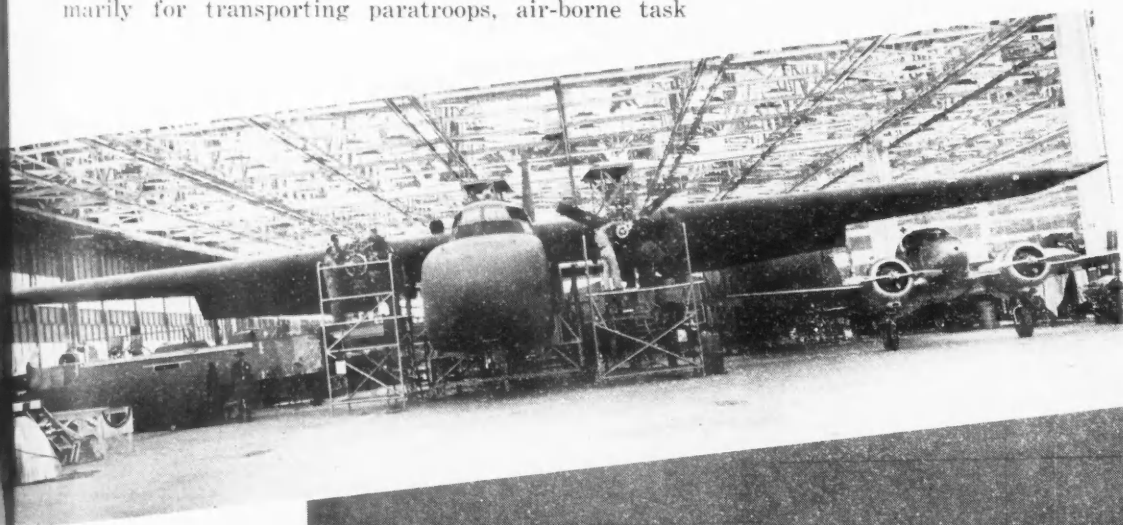
The caravan has a low-to-ground construction to permit rapid loading and unloading of cargo. The cargo floor is 36 in. above the ground.

Curtiss Caravan

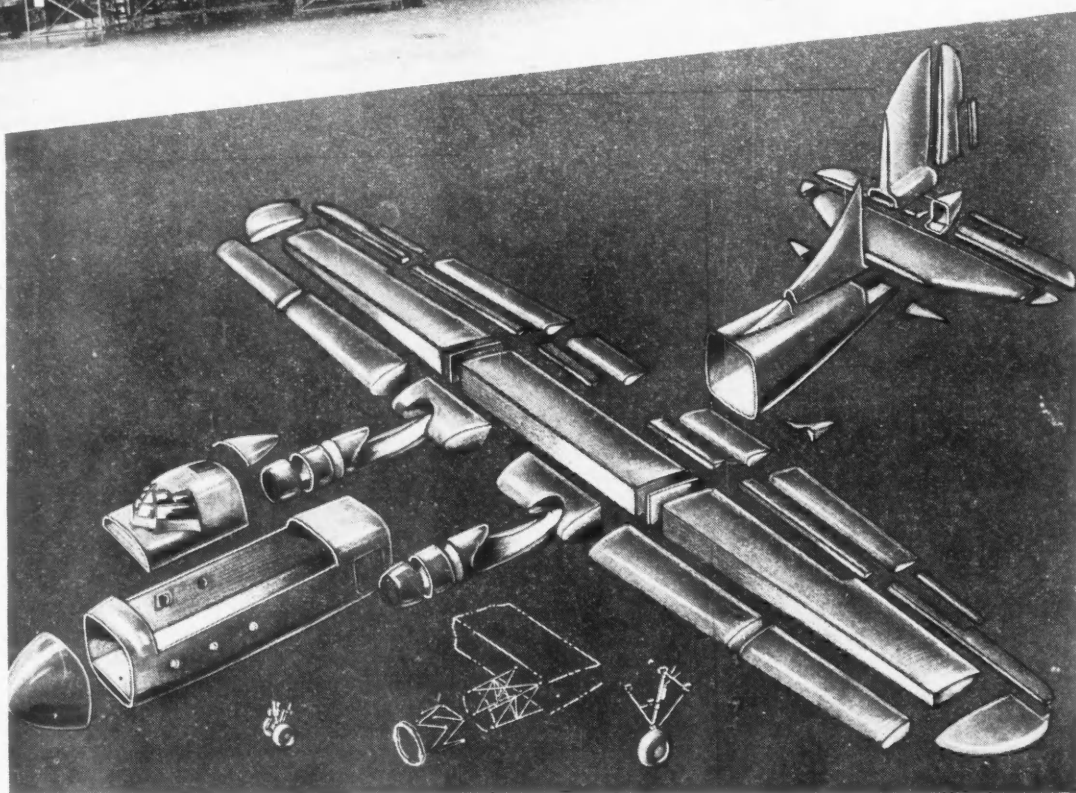
C-76 Transport

THE CARAVAN C-76, which is in production for the Army Air Forces at a Missouri plant operated by the Curtiss-Wright Corp., is said to be the first military transport of the present war having an airframe built almost entirely of non-strategic materials. Basically an all-wood airplane combining molded plywood, laminates and plain lumber, it has a wing span of 108 ft., a length of 68 ft. and is powered by two 1200 hp. engines. The landing gear is of the retractable tricycle type. Designed with a low-stalling speed, which makes the plane well-suited for "mushing" down in a short landing space to deliver urgently needed supplies, the Caravan is intended primarily for transporting paratroops, air-borne task

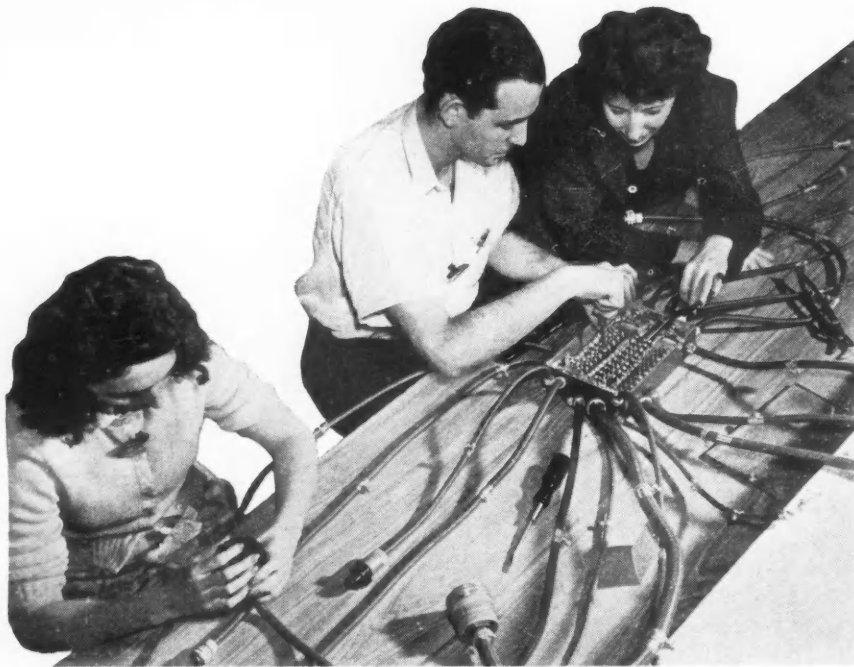
forces, field artillery and other military cargo over short runs of from 600 to 700 miles with frequent stops. A newly-erected Kentucky factory also is scheduled to start production of Caravans soon, using a system of sub-assemblies feeding into a main assembly channel. Cooperating in this project are three major sub-contractors, the Mengel Co., of Kentucky; the Baldwin Piano Co., of Ohio, and the Universal Moulded Products Co., of Virginia. The War Dept. also has selected the Caravan design as the type to be built in the Higgins shipyards.



(Above) The first Caravan as it nears completion at the Curtiss-Wright factory.



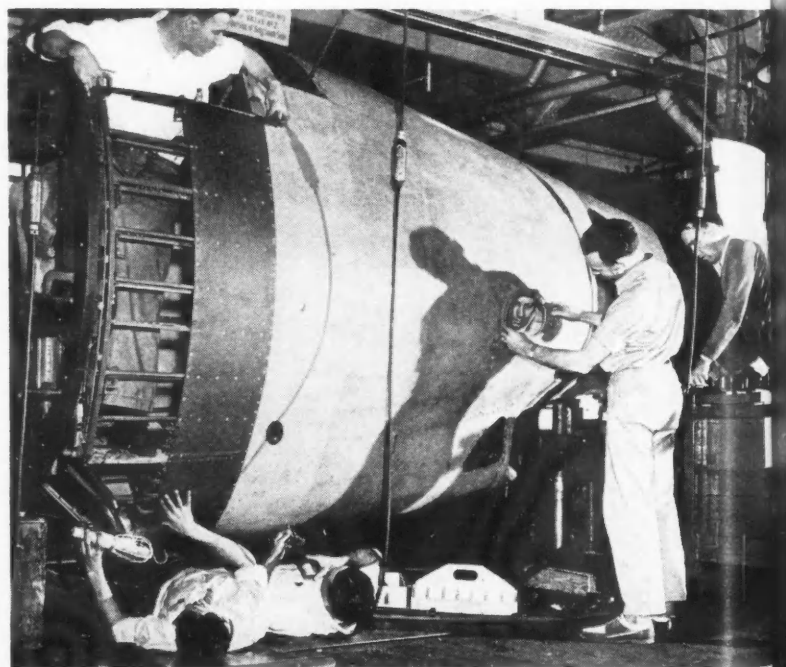
(Right) Production breakdown of the Caravan assemblies.



The Bloomfield, N. J., factory, which manufactured 4000 Delco-Remy storage batteries daily, now produces complicated electrical and hydraulic tube assemblies for the Wildcats and Avengers.

GM's Eastern A

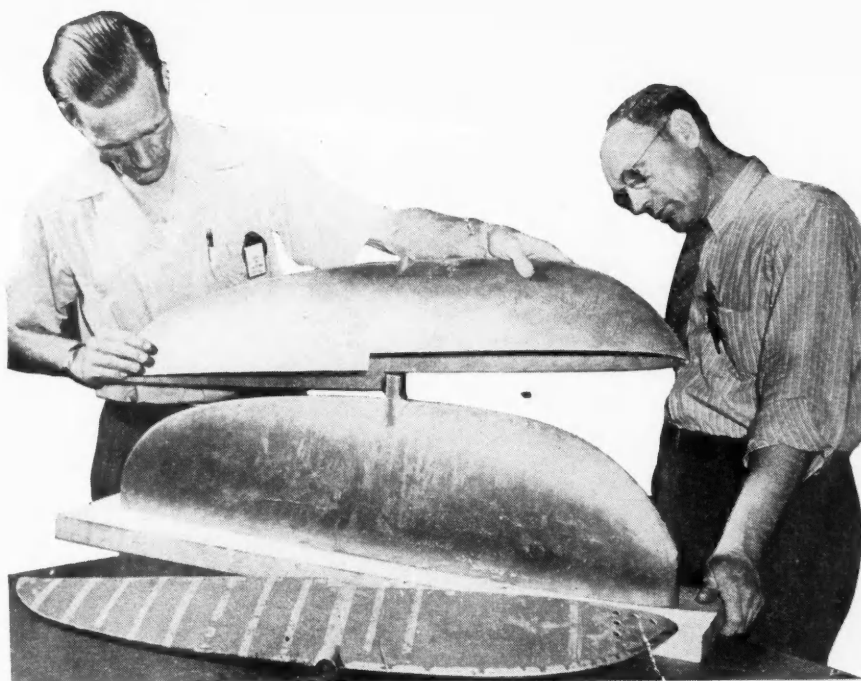
THESE pictures show some typical scenes at five former automobile plants of General Motors along the Eastern seaboard that have been organized as the corporation's newly-created operating unit, the Eastern Aircraft Division, and now are converted completely to aircraft production. Starting in February of last year, and amidst industrial conditions unprecedented in American history, in nine months over 60 acres of floor space were stripped bare of automotive equipment, then rebuilt and integrated as a manufacturing unit to build Grumman-designed Wildcat fighters and Avenger torpedo bombers for the U. S. Navy. To fabricate the 40,000 separate parts for the two ships and also their assembly, the management drew upon the successful production techniques of both the automotive and aircraft industries. Only a fractional per cent of the automotive equipment lent itself to immediate conversion. One innovation is the Change Department to control the purchasing and hold stockpiles from being overloaded with parts that would have to be scrapped on short notice due to



At the Baltimore, Md., plant where hundreds of Fisher bodies were turned out daily, parts and subassemblies for torpedo bombers are in production for shipment to the Trenton assembly plant. This photo shows workers assembling a fuselage rear section.

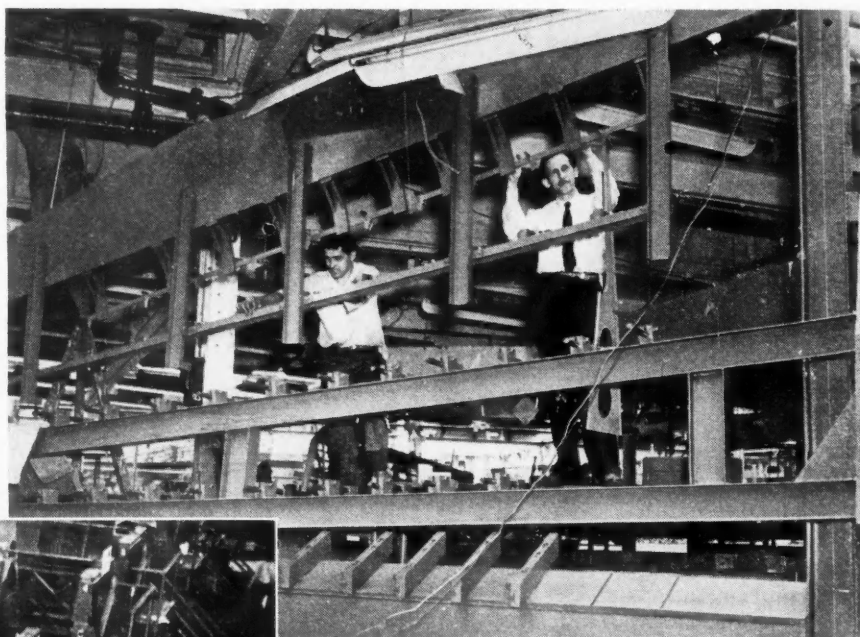
a sudden change in design, sometimes retroactive to planes already delivered. In this way is established small banks of many parts instead of large banks of few parts as was formerly common in automobile practice.

The Linden, N. J., plant has achieved the distinction of the first automobile plant in the country to be converted to the manufacture of complete aircraft. Buicks, Pontiacs and Oldsmobiles were assembled there at the rate of 60 cars per hour. It is the assembly plant for the Wildcat fighters and also fabricates many air-frame parts. Workers are examining a rudder tip coming from a new die. A single, elliptical-shaped piece was stamped out, cut in half and the two sides welded together.

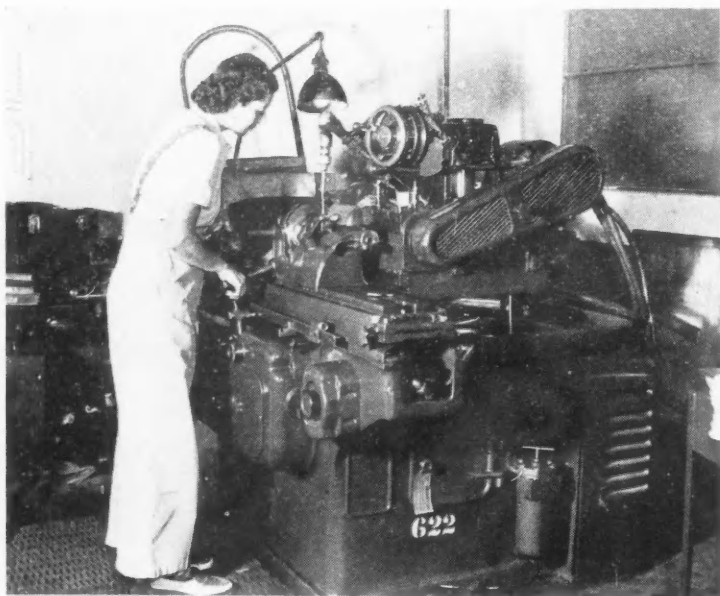


Aircraft Division

(Below) The Ternstedt plant at Trenton, N. J., formerly turned out 750,000 separate hardware items daily. Now Avenger torpedo bombers are assembled, some of the sub-assemblies also being built there. Others come from the Tarrytown, Bloomfield and Baltimore plants. Shown in the photo is one of the rows of "cradles" for assembling fuselage sections.



(Above) Here workers at the Tarrytown, N. Y., plant are setting up the upper section of a wing jig, one of many for Avenger subassemblies. Formerly this plant and the Baltimore plant turned out 1000 Fisher bodies daily.



Precision work is taught women in a few weeks. This girl grinds valve seats to a tolerance of .0001 in.

ADEQUATE personnel is a general problem today; rapid expansion plus unavoidable labor turnover tests personnel departments in most war plants. For manufacturers of precision products it is especially difficult. Adel Precision Products Corp., Burbank, Calif., manufacturer of line supports, anti-icing systems and hydraulic units, established a training system directed by the Engineering Department that has satisfactorily met these exigencies.

Hydraulic control valves and anti-icing pumps require precision measurements that must be correct within 0.0001 in. Metal-surfacing perfection that passes microscopic inspection also is demanded, for an abrasion invisible to the naked eye might cause a disabling leakage under high hydraulic pressures. The use of many gages and other testing and measuring devices required in fabricating these exacting units demands specialized workmanship, so to meet shop personnel expansion, Adel inaugurated a system of part - class and part-shop training for new employees that meets these special requirements.

Two full-time instructors are assisted in the classroom by shop foremen and supervisors with recognized teaching ability.

One hour of each trainee's shift is spent in class, where he learns, from screen-enlarged charts and pictures, the details of processing and assembling, and how to use tools and instruments. To save the shop time of foremen and leadmen, all questions are answered in class. Beginners learn more rapidly than where shop-training methods are used exclusively; courses requiring five months of trade-school are completed in five weeks with the Adel system of specialization. Trainees are taught the specific details of as-

sembling and inspecting Adel units, rather than general shop practice, thus specializing workers and limiting the inclination to shift from one company to another. Additional courses for employee advancement to more responsible and better-paying positions are also conducted.

Women are particularly adept at precision work, and they comprise the majority of new recruits. Instructors realize that women ordinarily do not have a background of mechanical interest and information, so technical terms are used sparingly, and instruction is planned to meet their understanding. For example, micrometer reading is taught by breaking down calibrations into a dollars and

cents system that women grasp in a few minutes.

There was only one hitch in the new training program. The engineering department not only had outlined an excellent system of training, but had devised shop and inspection methods considered best for rapid, accurate production of the company's specialties. However, trainees often reported that shop foremen insisted on different methods. At first students were advised to follow the foreman's instructions when there

Adel's Training S

was disagreement. This lack of coordination finally resulted in the inauguration of a course of instruction for supervisors and foremen to assure standardization of all procedures rather than the use of individual methods.

In pilot training, the Army Air Force Training Command discovered that cadet accidents were reduced 45 per cent when instructors were given a more intensive training. Adel found that production and morale were considerably improved by the same policy of refreshing their "instructors."

Courses of instruction for foremen and supervisors cover the latest, most pertinent shop methods, coordinate shop and classroom systems, outline employee-relationship techniques, and translate mechanical and systematic details into human equations, particularly in reference to the war.

Workmen sometimes get into a rut, where they are limited by their job of turning out one particular part, and lose sight of the vital place of the completed product in actual use. The foreman of a valve-seat-grinding department is made aware, in classes, of the vital importance of this small part to the flying soldier's

By George Tharratt

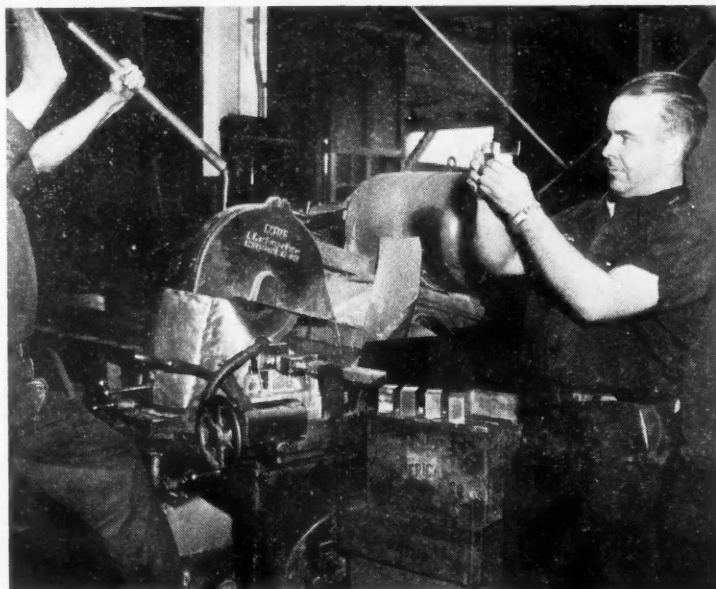
Chief Engineer, Adel Precision Products Corp.

A Radiac saw is used to cut aluminum alloy bar stock for bodies of hydraulic selector valves. In the training classes the value of this strategic material is stressed to prevent waste.

safety. An appreciation of the company's finished products is engendered when workmen realize that the accuracy and dependability of valves controlling wing flaps may mean a maneuverability response that out-flights an enemy plane in combat.

Foremen classes in hydraulics not only give an over-all, detailed technical outline of scientific principles, materials, processing and assembling, but explain how each unit is used, and why. Many of these men are good mechanics but, as in other war industries, they are producing units regarding the use of which they have only a vague idea. When a foreman realizes, for example, the importance of the four-way selector valve made under his supervision in controlling gun turrets, wing flaps, engine cowl flaps, retractable landing gear and other equally vital parts on military aircraft, he has a keener interest in his job (an interest which spreads to employees under him), and is more alert to speeding and perfecting production.

A company "trouble shooter" gives one of the lectures to foremen, and by specific examples impresses on his class the points that may slip by inspection and



later cause servicing trouble. He also takes units and parts from the factory scrap pile to indicate errors that cost material and time.

The number of inexperienced workmen necessarily employed makes it imperative that foremen be particularly alert in checking, especially in tool and jig making. They are reminded that if a job is started incorrectly, it will end incorrectly. Four tool operations are reviewed in these classes: tool design, checking, tool making, and inspection. The importance of keeping a close tab on workmen as they use tools is stressed, for one wrong move can ruin a valuable tool. The proper care of tools also is reiterated; if a tool is used after it has been nicked, parts will be ruined.

(Turn to page 80, please)

g System

of combined class instruction and shop work

Typical "job tickets" in Production Illustration. This system is used in the classroom as slides to explain the relationship between individual operations and the entire unit assembly. In the shop these charts are posted in front of each operator, showing exactly what to do, how to do it and time required. Production Illustration breakdowns are prepared by a group of engineers, supervisors and leadmen who determine the various breakdown steps and time required for each operation.

JOB TICKET NO. 28-5

TOOLS REQUIRED
T-9098 FOR USE WITH SHOULDER #2 ARBOR PRESS

PARTS REQUIRED

1271 FRONT BEARING-7032	1 REQ.
1291 ARMATURE-8371- SEE VARIATION CARD	1 REQ.
1301 REAR BEARING-7042	1 REQ.

PROCEDURE

OPERATION NO. 1
SET REAR BEARING (1301) IN RECESS OF BASE PLATE OF (T-9098). HOLD ARMATURE (1291) WITH LEFT HAND. TAKE FRONT BEARING (1271) WITH RIGHT HAND AND INSERT IT INTO END OF (T-9098). BRING UP ARMATURE SO THAT IT LINES UP WITH THE FRONT BEARING (1271) AND AT THE SAME TIME HOLD BEARING IN PLACE.

OPERATION NO. 2
WITH RIGHT HAND, PULL LEVER ARM DOWN SLOWLY. WHEN YOU HAVE REACHED A POINT WHERE THE LEFT HAND ALIGNS UP BOTH BEARINGS WITH ARMATURE SHAFT, THEN APPLY MORE PRESSURE TO ARBOR PRESS ARM WITH RIGHT HAND AND WITH LEFT HAND KEEP ARMATURE STEADY. APPLY PRESSURE UNTIL BOTH BEARINGS ARE SEATED ON THE SHOULDER OF THE ARMATURE.

NOTE - THIS SUB-ASSEMBLY CONSISTING OF 30, 29 & 27 WILL HEREAFTER BE NO. 29A

OPERATION NO. 1

OPERATION NO. 2

ADEL PRECISION PRODUCTS CORP.
1077 VAN OWEN ST. BURBANK, CALIF.
PRODUCTION ILLUSTRATION
JOB TICKET NO. 28-5

Airbriefs

By Henry Lowe Brownback

Small Radials Return:

We Americans have always had one fault in our designing of vehicles, save in rare cases. We had always tended to rely on "good old horsepower" rather than on refinement of design for performance whether it be in motor cars, trains or airplanes.

This was clearly shown at Los Angeles several years ago when the Caudron plane fitted with a little eight (8) litre Renault engine ran away from competing planes of several times its piston displacement. Add to this the fact that most of the planes which have been designed for great inherent stability whether of the fixed or rotary wing type are slower than even the less efficient planes of the ordinary types and most of the "clean" planes land fast and require flaps, spoilers, etc., to lower their landing speeds and the operation of these devices requires skill. One may say, "So what? We are teaching thousands of young men to fly planes of all types every day." That is all right but if we are going to keep an aircraft industry going full blast after the war it means hundreds of thousands of private buyers of all ages, physical condition and manual dexterity. However, to permit anyone who has the price to fly means a distinct let up in some of the government regulations and in the design and construction of planes which can be flown by simply putting a lever into climbing, flying or gliding positions and maneuvering with the rudder and throttle. It means that the plane will have to be as easy to start and to service as an ordinary car, something that can carry four people at better than 100 miles per hour cruising speed on two and one-half gallons of gasoline per hour.

It also means that we will have to revise radically our present cost structure as far as aircraft is concerned. Today designers of molded wooden planes base their cost on approximately five dollars per pound and the metal men have to count from 10 to 12 dollars per pound and, while the present-day airplane is not a line assembly job in the same sense that the motor car is, the quantities involved are great enough to make certain economies possible. While the present-day small plane in the United States has been built around three makes of small engines all having four cylinders in two

opposed banks of two I still think that the small radial which once absolutely dominated the field will be in the running again.

Bombers:

A few months ago a great furore broke out all over the Allied camp when a returning Congressman brought some pretty bitter European criticism of our four-engined bombers. "They couldn't carry as many bombs as current European types. . . ." Today the American machines have emerged from the dog house as they have shown that they can fly long distances, bomb and return to their base without the fighter protection which the more lightly armed European bombers require. It is again the old story of what to do with the weight or load the engines can lift off of the ground and drive through the air. Refinement increases speed and in consequence the distance which a given quantity of fuel will drive the load and aside from that we get back to the old saw of heavy loads at lower speeds or over shorter distances with the same power and fuel tank.

Freezing:

After the last war the surplus military planes were used for many purposes and the sales of trainers at bargain prices to barnstormers and embryo airlines really gave aviation great impetus. This time the planes are of a type which cannot be readily converted to peace-time use, save, perhaps, some bombers which will make cargo carriers. One enterprising firm has evolved a scheme for the use of war surplus high altitude bombers, which has interesting possibilities.

This firm has been freezing vegetables and fruits and it appears that the only way to do it economically is to carry bulky, fast-freezing apparatus to the crop being picked and to freeze it. As I understand it, the real job is to freeze fast and this requires a lot of power, but to maintain the stuff in a frozen condition is easy. The new plan is to fit cargo planes with racks which can be loaded with fruits and vegetables which will then be flown in a fast climb to about 15,000 feet altitude where it is usually colder than the coldest of freezers and open air

ducts to the compartment. The stuff will be frozen almost instantly and then the openings will be closed and the plane glided in and the frozen produce transferred to the warehouses.

Paper Work:

Everyone connected with the aircraft industry suffers an extreme case of jitters when paper work is mentioned in the same breath as the government. Delays have occurred and are occurring because of constant charges demanded by the military services and because of lack of material and machines, often aggravated by the very real dispute between the Army-Navy Munitions Board and the W.P.B.

While I can take no sides it seems to me that the persons who know best what our army and our allies' armies need most are our professional soldiers, and while it may be bad politics and bad "morale" building to let them do the deciding instead of "Lend-Lease," W.P.B. or a flock of theoretical economists, it might help get things done and lift a load from the shoulders of manufacturers who spend days getting a priority from the A.N.M.B. only to have it turned down by the W.P.B. Add to this the fact that the technicians and executives are bedevilled by all sorts of questionnaires of a nature so personal that they would have caused an unpleasant reaction in the days of George Washington or Abraham Lincoln in order to satisfy statistics-mad bureaucrats and asked further to determine all of the material they will need for the next year in proportion to some statistics on available materials or what materials can be salvaged after Lend-Lease gets what it wants. Even the statistics-mad theorists jamming the gigantic buildings at Washington would take longer to make this "work" than any war will ever last and it certainly is tearing down the morale of many manufacturers. Here's to the health of the few Senators and Congressmen who are demanding a return to reason.

Gliders:

After all of the grief *Airbriefs* had with the locale of glider development, we are sorry to note that there is an ever-growing coolness to the glider program on the part of the military authorities. This does not seem to come from the fact that the glider is less useful than it was first hoped but because it must be transported to its point of use while the parachute-carrying airplane can fly there. It is also evident that the larger gliders need a larger plane to take them off than was thought to be necessary. It may be that the authorities in their efforts to get superlative gliders went too far and really designed engineless airplanes instead of simple gliders which would have done the trick as well. I have seen our big gliders fly and from that angle they are a fine job.

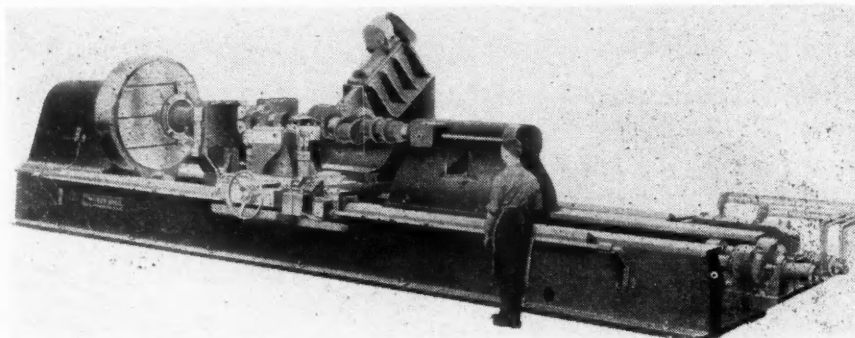
New Production Equipment

AN EXTRA heavy duty universal type crankshaft lathe, the Model UH-60, is being manufactured by Wickes Brothers, Saginaw, Michigan. This machine is a single end drive lathe, designed especially for machining the main journals of heavy duty Diesel type crankshafts having journals up to 10 inches in diameter. A back roller rest is used for supporting the journal being machined in order to prevent deflection of the crankshaft during the machining operation. This back roller rest is carried in a heavy back tool housing and is movable along the lathe bed to any desired position. A heavy duty four roller steady rest is shown supporting a journal which had previously been machined.

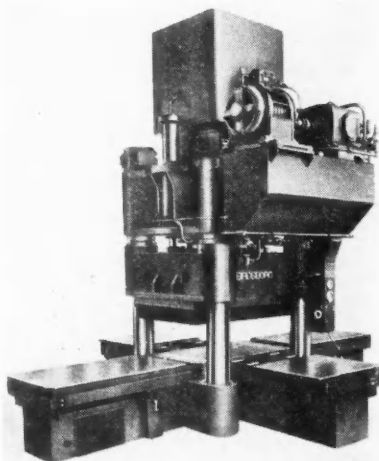
A 3-way turret is mounted on the cross slide, and tooling is provided for turning, checking and filleting operations. Hydraulic feed is provided to the carriage and to the cross slide. The hydraulic feeds are from .005 in. to .125 in. per revolution through variable delivery hydraulic pumps. The main drive motor, the feeds and the rapid traverses are controlled from electric drum switches on the apron.

This lathe has a swing of 61 in. over the bed and 36 in. over the cross slide. The machine with 29 ft. bed will take crankshafts up to 16 ft. in length, and special bed lengths are available if required. The main drive motor is 30 hp., adjustable speed, direct current.

A SELF-CONTAINED cooling unit, designed to supply a constant flow of low temperature water to electric spot welder tips and transformers, is being offered by Temprite Products Corporation, Detroit, Michigan. The unit operates as a water circulating system, and can be used to operate one,



The Wickes Brothers Model UH-60 Crankshaft Lathe



Hydraulic Press Built by Birdsboro Steel Foundry and Machine Company.

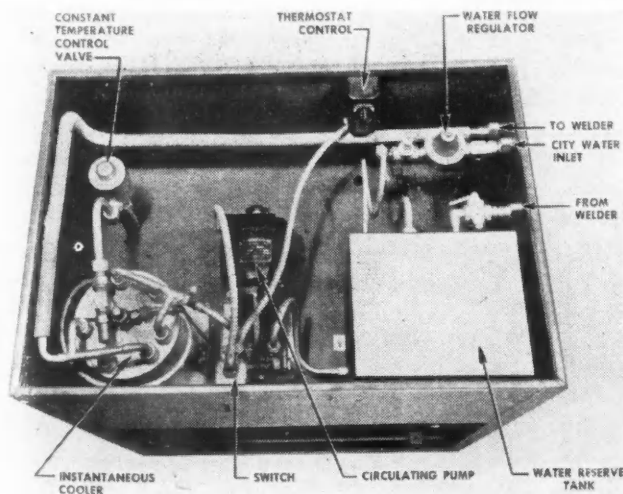
two or three spot welders, depending on the maximum heat load of the welders and the resistance to flow through the welder water circuit. This model, the 580-WC, is equipped with the proper size Temprite instantaneous water cooler and all accessories, including the Temprite constant temperature control valve, a one-horsepower refrigeration condensing unit, and a one-half horsepower water circulating pump.

The system is capable of circulating 120 gallons of water per hour against a spot welder pressure drop of 100 pounds gage. The pump is equipped with an adjustable by-pass valve so the rate of water flow through the spot welder assembly can be controlled.

FOUR separate loading platforms are provided on the hydraulic rubber pad airplane press announced by Birdsboro Steel Foundry and Machine Company, Birdsboro, Pa. It is claimed that this new design speeds up output by eliminating loss of machine time. Tables can be provided in various lengths; long tables for long work or short ones for smaller parts.

Loading and pressing operations are synchronized and are automatically controlled. Table and press cycle can be interrupted instantly by any of the operators. Full manual control is available for set up, tryout, and special work requirements.

CIRCO PRODUCTS COMPANY, Cleveland, Ohio, has developed a machine for flushing, cleaning and reoiling oil temperature regulators. This machine, the
(Turn to page 72, please)

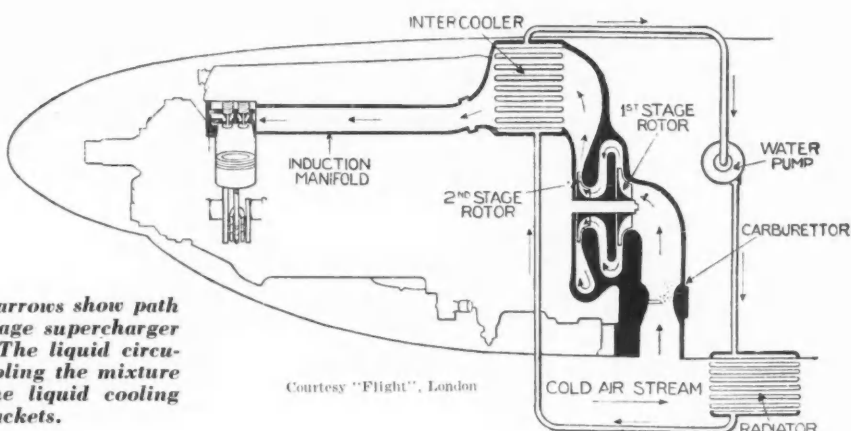


The Temprite Spot Welder Cooler.



Aeme

Equipped with the new Rolls-Royce Merlin "61" engines and four-bladed propellers, these latest British Spitfires are on their way for a sweep across enemy territory. Each has armament of two cannons and four machine guns.



Courtesy "Flight", London

In simple diagrammatic form arrows show path of fuel and air through two-stage supercharger and intercooler to cylinders. The liquid circulating system by pump for cooling the mixture is entirely independent of the liquid cooling for the cylinder jackets.

By M. W. Bourdon

Special Correspondent of
AUTOMOTIVE and AVIATION
INDUSTRIES in Great Britain

IF THE same basic design as the series of Merlin engines that have been current for roughly 10 years, a version that represents a big advance in performance and operational scope without increase of piston displacement has been produced by Rolls-Royce engineers. Known as Type 61, the outstanding difference of this new engine from the Merlin XX is in the provision of a two-stage supercharger with two

ROLLS-ROYCE MERLIN "61" DATA

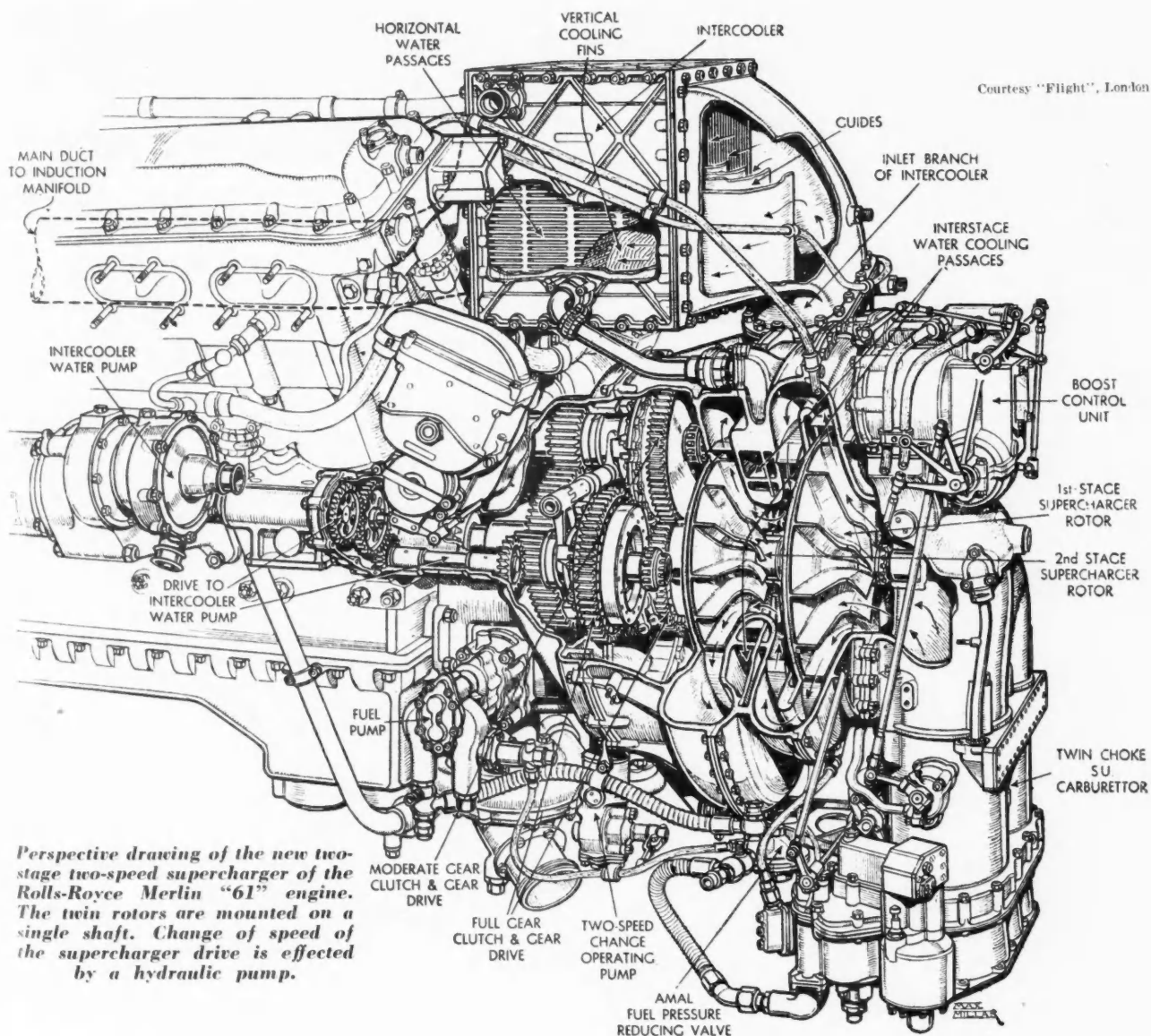
No. of cylinders	12, in two monobloc castings set at 60 deg. with detachable heads
Bore and stroke	5.4 in. x 6.0 in.
Piston displacement	1649 cu. in.
Valves	2 inlet and 2 exhaust per cylinder with overhead camshaft and rocker arms.
Coolant	Water and glycol (30 per cent)
Compression ratio	6.0 to 1
Propeller gear ratio	0.42 to 1
Rotation	Engine, right-hand; propeller, left-hand

speeds and an intercooler between supercharger and the induction manifold.

Although no information as to the power output of this new Merlin has been released for publication, it is stated to develop roughly twice the power of the original Merlin III (The Merlin III rating is 990 hp; the Merlin XX, 1260 hp. Ed.), and to give the latest Spitfire fighter, to which it is fitted, with a four-blade propeller, a ceiling of upwards of 40,000 ft. At that altitude it is said to operate on a charge compressed to six times the surrounding atmospheric pressure. Although the two-stage, two-speed supercharger and intercooler provide their principal benefit at high altitudes and have been devised and adopted chiefly on that account, they have advantages that can be interpreted also into improved performance at relatively low altitudes.

The two-stage supercharger is located in the same position as the corresponding unit on the Merlin XX engine (at the rear) and is driven similarly through clutches and either of the two-ratio gear trains, with

Rolls-Royce Merlin "61"



Perspective drawing of the new two-stage two-speed supercharger of the Rolls-Royce Merlin "61" engine. The twin rotors are mounted on a single shaft. Change of speed of the supercharger drive is effected by a hydraulic pump.

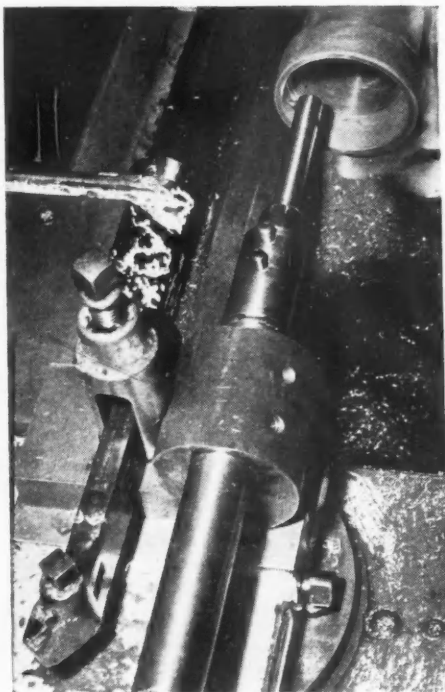
speed change effected by a hydraulic pump. Air is drawn through an improved and larger S.U. updraught twin-choke carburetor. The mixture is then compressed in the first stage through a centrifugal rotor of large diameter, and then passes on for further compression through a smaller rotor on the same shaft as the other. At this point the compressed mixture has attained to a temperature of around 250 F; this is reduced to about 110 F by the mixture passing

through the intercooler before reaching the induction manifold feeding the two banks of six cylinders.

A square box-like structure, the intercooler is mounted above the casing of the supercharger and auxiliary drive gears. The box contains a radiator through the horizontal tubes of which liquid coolant is circulated, the mixture passing around and between the tubes. The consequent reduction in temperature is

(Turn to page 70, please)

Short

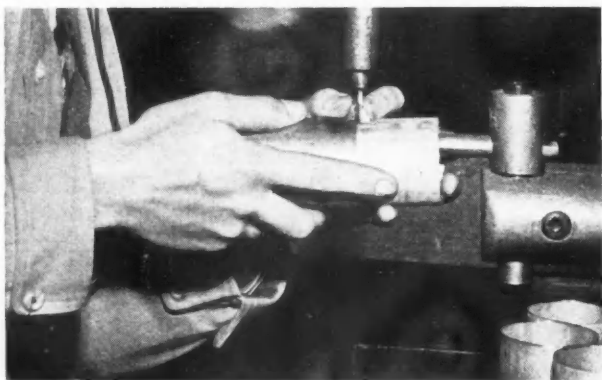
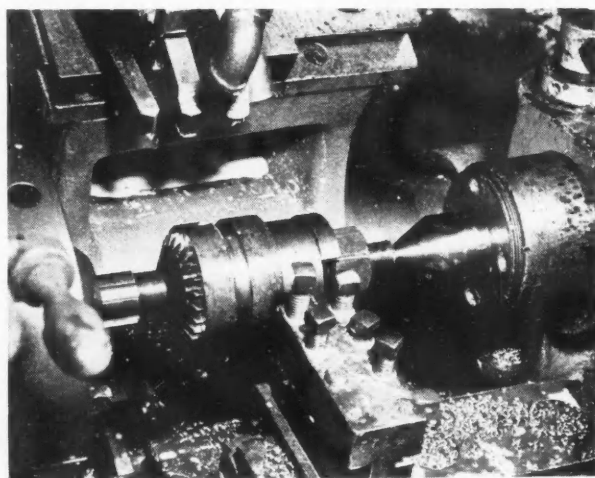


(Top Left) This quick-change boring bar, incorporating a holder to which cutting tools of various types and sizes can be attached, was developed at the Douglas Aircraft Co. by Victor Sundquist and is said to save from 50 to 75 per cent of the time formerly required to do a job. The cutter is fixed in the holding bar with two set screws. It has been found to be particularly advantageous for machining hydraulic booster valves as only one setup is necessary for the many and varied boring cuts inside the casting.

(Right) A clamp developed in the paintshop of Northrop Aircraft has speeded up production of priming sheet stock from 30 to 50 sheets per hour. At the old rate the sheets sometimes were wet enough to stick together after being loaded on a truck. With the new method there is adequate time for the sheets to dry, and sticking together is prevented. Cleaning of the "A" racks formerly used also is eliminated, which resulted in a time saving of 3 to 4 hrs. per week.



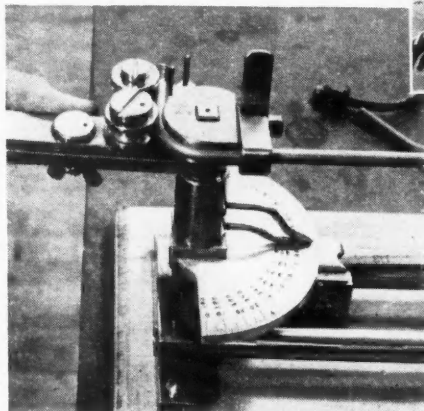
(Right) At the plant of General Motors Truck & Coach, Pontiac, Mich., a general drive coupling ring formerly was turned on a standard lathe and then was chamfered in another operation on another machine. One of the machinists developed a plan whereby two of the coupling rings now are placed on a splined arbor which is put into an automatic lathe. Both rings are turned and chamfered at the same time. Production is increased 68 per cent and approximately 200 hours are saved every month.



(Left) A jig used to tack lugs to exhaust-manifold port tubes for spot welding is made of tubing that will slide over the port tube. A lug guide and stop are set in a position to guide the lug in place. The grooved top tip of the spot welder is used to contact the top of the lug. Low pressure and high current are used to make the weld. To weld these parts, the tube is inserted in the jig until it hits the stop. The lug is placed against the guide, which holds it perpendicular to the tube, and it is then placed in the spotwelder and tacked. This time-saving and accurate method is due to a welder of the Ryan Aeronautical Co.

Cuts

(Below) Dzus fasteners formerly were placed in position on a motor cowling by hand. The squeezer then forced them into the grommet, and because the operator's hand had to be in the zone traveled by the squeezer plunger, several rather serious thumb injuries occurred. In the sheet-metal department at Lockheed's, the adapter shown in the photograph now lines up the Dzus buttons automatically, inserts them into the grommets, and squeezes them into the proper position without requiring the thumb to be placed in the danger zone. This little device has enhanced both the safety and the speed of the operation.



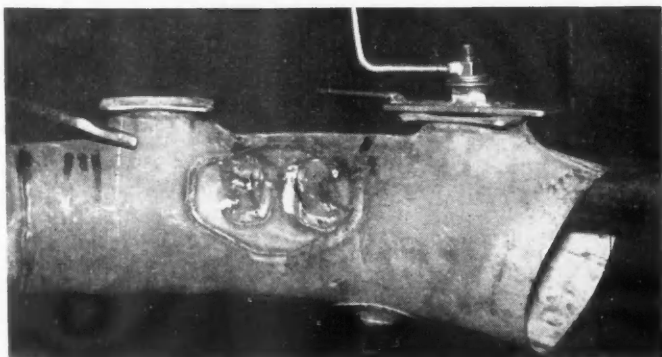
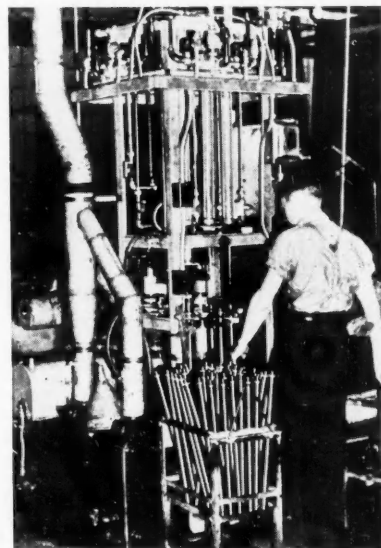
More Short Cuts on
the next two pages



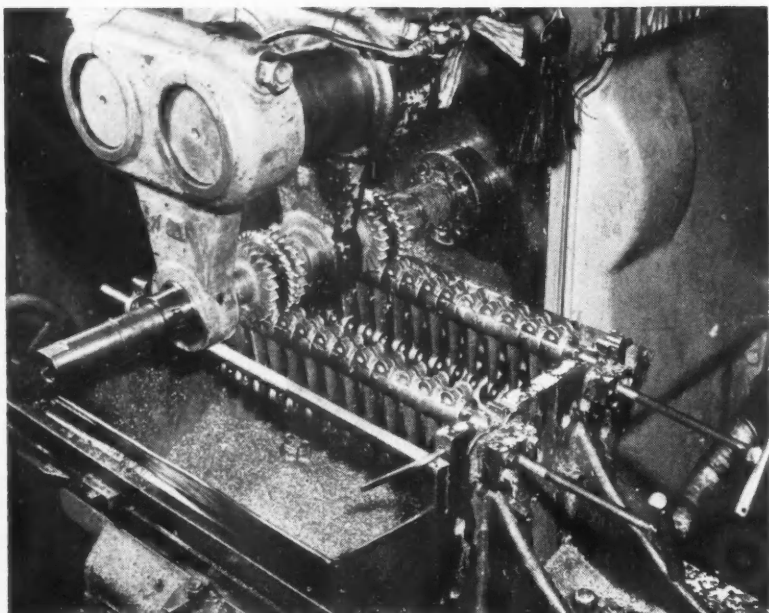
(Right) Washing the rifling of machine guns is an important operation. Formerly this washing operation was effected by hand, the barrels being dipped in hot cleaning solution and then scrubbed. Saginaw Steering Gear Division of General Motors designed and built a special machine (see illustration) which is completely automatic and which speeds production 50 per cent.



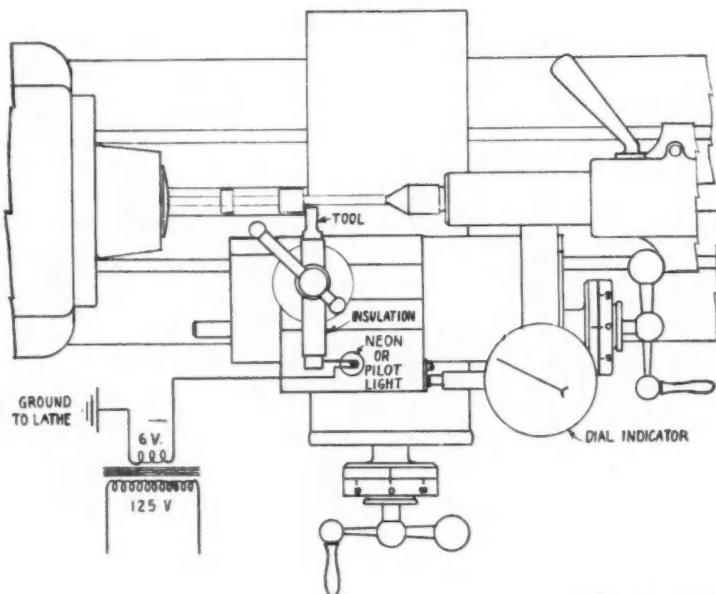
(Above) The Holly tube bender, a precision machine developed by production engineers at the Vega aircraft plant, enables the operator, by a unique system of gages, to make any bend within one-half degree of accuracy in small tubing ranging from $\frac{1}{8}$ in. to $\frac{5}{16}$ in. dia. Forming blocks of the quick clamping type, containing special forming grooves, prevent the tube from flattening while being bent. Over-all, it is about four feet long and 10 in. high. Under the former method, 400 bends were made per shift, but with many rejects, and the setup could be operated only by men as the work was too difficult for women. With the Holly machine, a woman can make 1800 bends in the same time with practically no rejects.



(Left) Finding it necessary to hold exhaust-manifold sections securely while "ironing out" wrinkles around the ports, an employee of Ryan Aeronautical Co. devised this clamp. It is inserted through the port, and hooks over the dolly bar. A nut with a handle welded to it clamps the hook against the flat plate which covers the exhaust port.



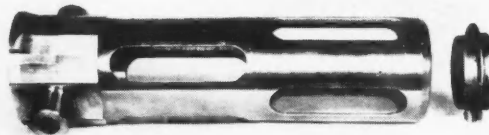
(Above) Until recently brake cross-shaft levers were milled on their clamping lugs, two at a time, at the plant of General Motors Truck & Coach, Pontiac, Mich. One of the milling-machine hands doing this operation developed a fixture which makes it possible to hold and mill 40 of these levers at a time, as shown by the illustration.



(Above) Means which will make it easier to obtain very high precision in lathe work have been devised by M. M. Cunningham, a foreman at General Electric's Schenectady works. As shown in the drawing, the lathe tool is insulated from the tool post and is included in a circuit with a source of current, a neon lamp, and the lathe bed. In operation, the tool is advanced toward the work in the usual manner until it is about to make contact. From that point on it is advanced very slowly until the pilot light begins to flicker. Very little further movement causes the pilot light to become steady, and when it is, the indicator is set to zero. The tool can then be set for any desired depth of cut, and the accuracy of the cut will depend only on the dial indicator.

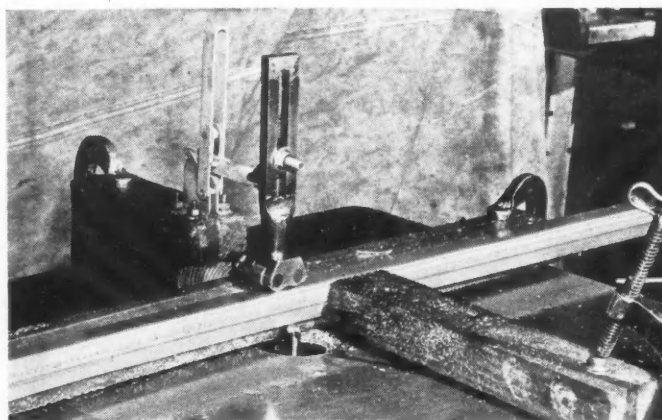
Short

Continued from the



(Above) Gun-barrel spring casings for 20-mm anti-aircraft machine guns formerly were made of solid forgings weighing 56 lb and were machined down to a weight of 6 lb, so that as much as 50 lb of expensive scrap was produced. Pontiac Motor Division (General Motors) has evolved a method of production whereby a forged base is welded to a tubular shell. The unfinished part now weighs only 14 lb, so that the amount of scrap is reduced to 8 lb. In addition, several heavy drilling operations are eliminated, several machine tools are released, and 3.7 man-hours and \$12.71 are saved per unit. The illustration shows the finished casing.

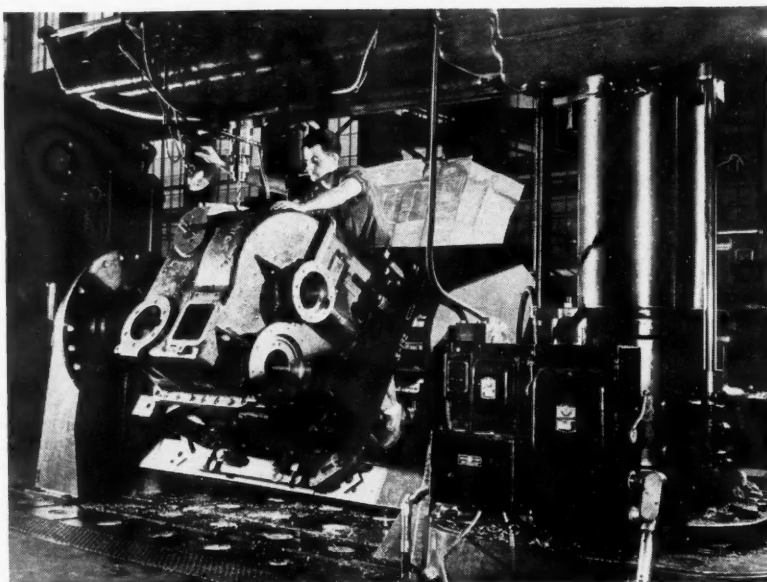
(Below) The simple clamp-type pressure foot illustrated herewith, which was originated by an employee of Consolidated Aircraft Corp., can be installed on shaping or trim saw machines to hold the material firmly to the cutting-blade shoulder. It has the effect of eliminating undercutting, chattering and gouging of the material being worked. Because of the firm pressure exerted, the blades will produce more work, and the tool will need sharpening less frequently.



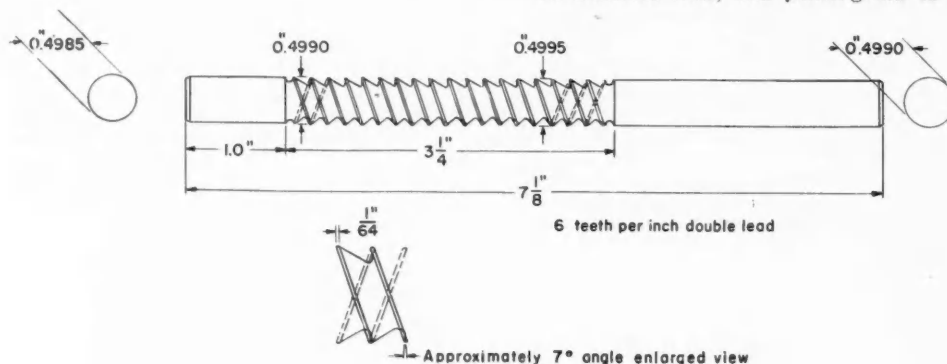
Cuts

preceding pages

(Right) A universal indexing trunnion fixture for drilling marine gear casings has been designed and built at one of General Electric's major works. About 110 holes must be drilled, tapped or spot-faced in each of the casings, which latter vary in weight from 1000 to 2000 pounds. The table is mounted on a frame carried by two pairs of trunnions; it can be turned around one pair by a $\frac{3}{4}$ hp geared motor through a chain and worm-gear drive. A circular indexing plate with 18 holes on its periphery permits setting the table quickly in any of the angular positions called for. When the table is to be rotated around the other axis, it must be in the horizontal position, with the work right-side up. After clamping bolts at the four corners of the table have been removed, the operator, by means of a lever below the fixture, raises the table just enough to clear the frame, and then turns it by hand to the position desired, and locks it there.



(Below) A broach designed by Howard Fancher of General Electric's Schenectady Works finishes holes to within 0.0002 in. of absolute roundness and straightness. It is used to finish-broach the bore of gear blanks and similar parts where the initial machining operation has to be held close to prevent the building up of errors in subsequent operations. The broach is made of high-speed steel, with a pilot of the diameter of the rough-broached hole, a double Buttress thread, and a shank the diameter of the finished hole and long enough to push the Buttress through the work. The reaming portion has a taper of 0.0004 in. in 2.5 in., and the last half inch is left the size of the finished hole. A good burnishing effect is obtained if the last quarter inch is not backed off as much as the cutting part of the broach. The broach is machined as follows: Rough-turn and chase Buttress thread, harden and rough-grind, grind undercut on Buttress lead, and finish-grind to size.



(Left) In grinding thin-walled cylinder barrels of Pratt & Whitney aircraft engines at the Ford plant, use is made of water-cooled arbors to keep down the temperature and prevent distortion of the work. The accompanying photograph shows component parts of the patented arbor. Water enters at the end of one center, flows through the arbor, and is discharged through a small orifice in the other center which is clearly shown in the view at the lower right. A pressure of one pound per square foot is maintained on the cooling medium. In the photograph at the left is shown the arbor, which is provided with orifices through which the coolant passes to the inside of the cylinder barrel. In the center at the rear is shown a cylinder barrel before it has been ground, and at the right rear, a barrel which has been ground. By cooling the cylinder barrels both inside and outside, it was possible to reduce the grinding time from 90 to 20 minutes.

Inspecting Liberator (B-24)



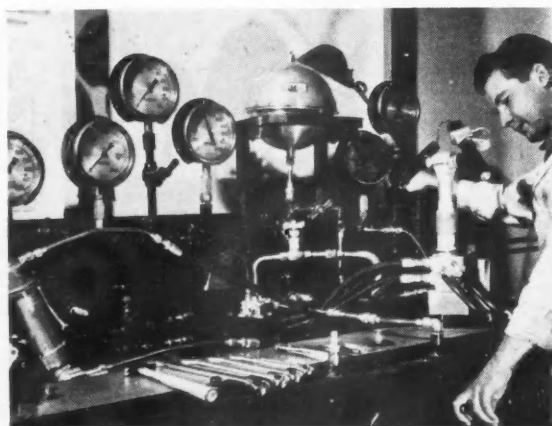
(Upper right on facing page) Flight instruments must pass tests under high altitude conditions which are simulated in this chamber.

(Right on facing page) Every instrument on a Liberator panel is inspected after installation.

(Below) Radio installations on Liberator bombers are given a careful inspection on the final assembly line.

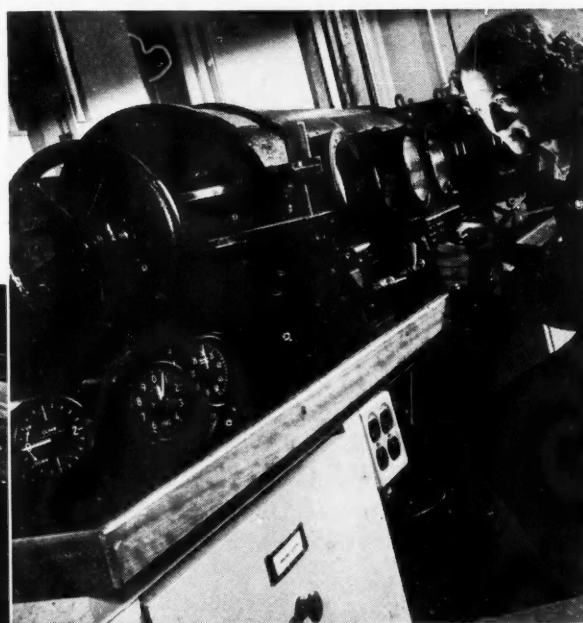
(Above) First step of a Liberator final assembly is the mating of the component sub-assemblies. The inspector uses a transit to insure correct mating.

(Below) This setup is used for testing hydraulic controls.



Heavy Bombers

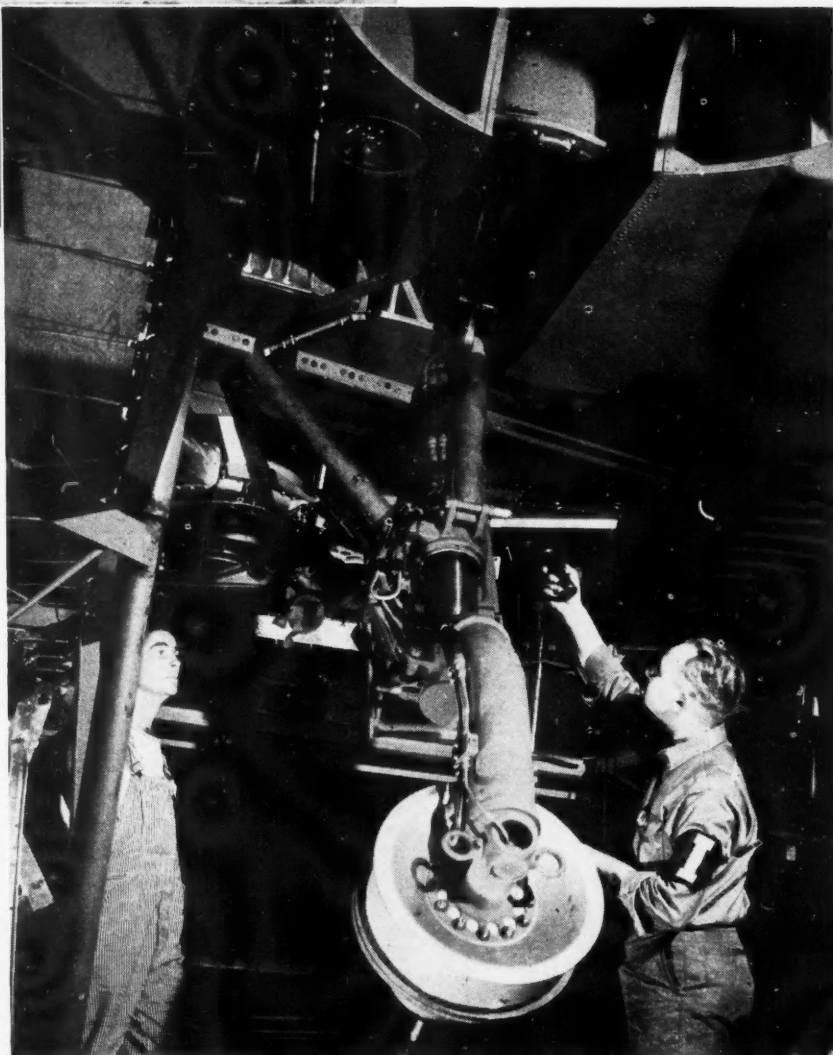
at Consolidated



(Below) This photo shows the complex hydraulic and electrical hookups of the landing gear that must be checked by expert inspectors.



(Below) High altitude oxygen equipment is checked thoroughly at this inspection station.

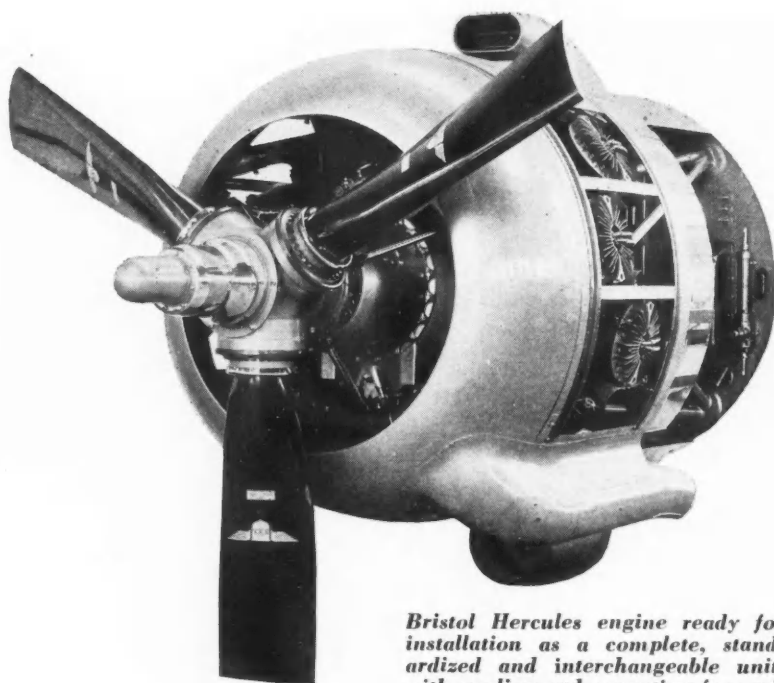


Interchangeable Power P

By M. W. Bourdon

Special Correspondent of AUTOMOTIVE and
AVIATION INDUSTRIES in Great Britain

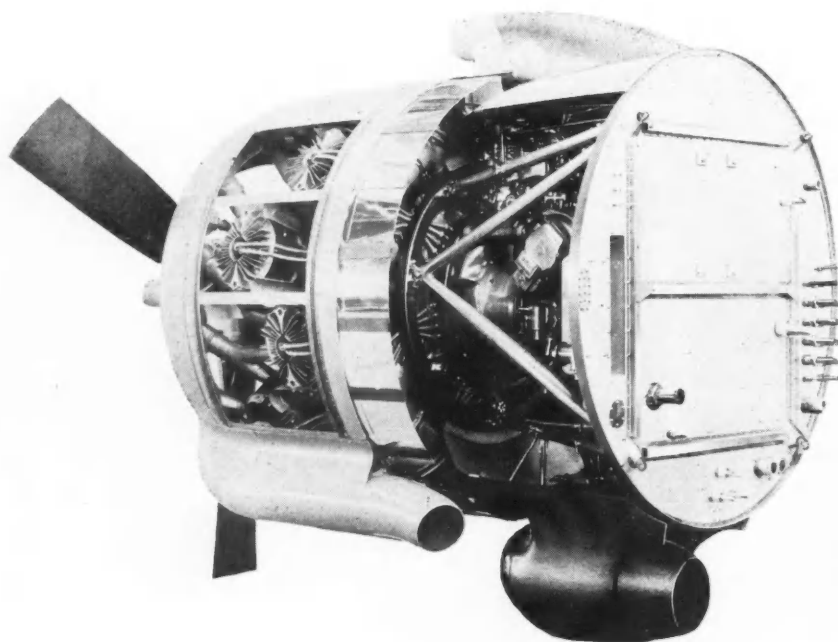
THE Bristol Hercules air-cooled engine, a 14-cylinder sleeve valve radial, is now being supplied to aircraft assembly plants in Great Britain as a complete power plant consisting of the engine, a standardized mounting, fireproof bulkhead, exhaust collector ring, oil cooler, long-chord cowlings, controllable gills and baffles, fuel and oil pipes, and all accessories that serve the engine itself, the latter group being mounted on the rear cover of the crankcase. Those accessories are the oil pumps, dual feed pumps, magnetos, and propeller constant-speed governor unit. All other accessories, such as airpumps, hydraulic pumps for undercarriage operation and various controls, are driven from a separate accessory gearbox mounted on the front face of the bulkhead. This gearbox is driven



Bristol Hercules engine ready for installation as a complete, standardized and interchangeable unit, with cowling and mounting for various types of aircraft. It has been named the Bristol Hercules Power Egg.

by the engine through a flexibly jointed shaft and provides alternative arrangements in regard to the number and type of accessories it drives, thus catering to the requirements of different installations.

This policy of supplying complete and standardized power units has been developed as a result of collaboration between the British Air Ministry and various aircraft engine manufacturers, and is of particular interest and importance as affecting the Bristol Hercules and the Rolls-Royce Merlin engines. One result is that the Hercules engine in certain two-engined and four-engined aircraft can be interchanged with the Merlin engine. For example, the latest of the British four-engined heavy bomber, the Lancaster, can be fitted with either Merlin or Hercules engines. Then, too, the Hercules power



Rear view of the Bristol Hercules 14-cylinder sleeve valve radial engine, showing the standardized mounting, bulkhead, oil cooler, air intake, exhaust outlet and controllable gills for the air-cooling.

r Plants for British Bombers

plants of the Stirling four-engined bomber are interchangeable with those of the Beaufighter, the two-engined long range fighter that has gained so many successes in combat on many fronts of the air war. As a further example, the Beaufighter, although normally fitted with Hercules engines, can have Merlin power units installed with only detail modifications of the airframe—those concerned merely with controls.

The policy of standardized and interchangeable power units obviously makes for relative ease and time-saving in respect of maintenance, particularly under active service conditions, for, when engine overhaul or repair becomes essential, changing the power unit for another of the same type ready for immediate use occupies a comparatively short time—not much more than minutes compared with hours where there has been no attempt to provide for standardization and interchangeability.

The interests of the manufacturers of both engines and airframes are furthered by the standardization of complete power units. The engine manufacturer, on

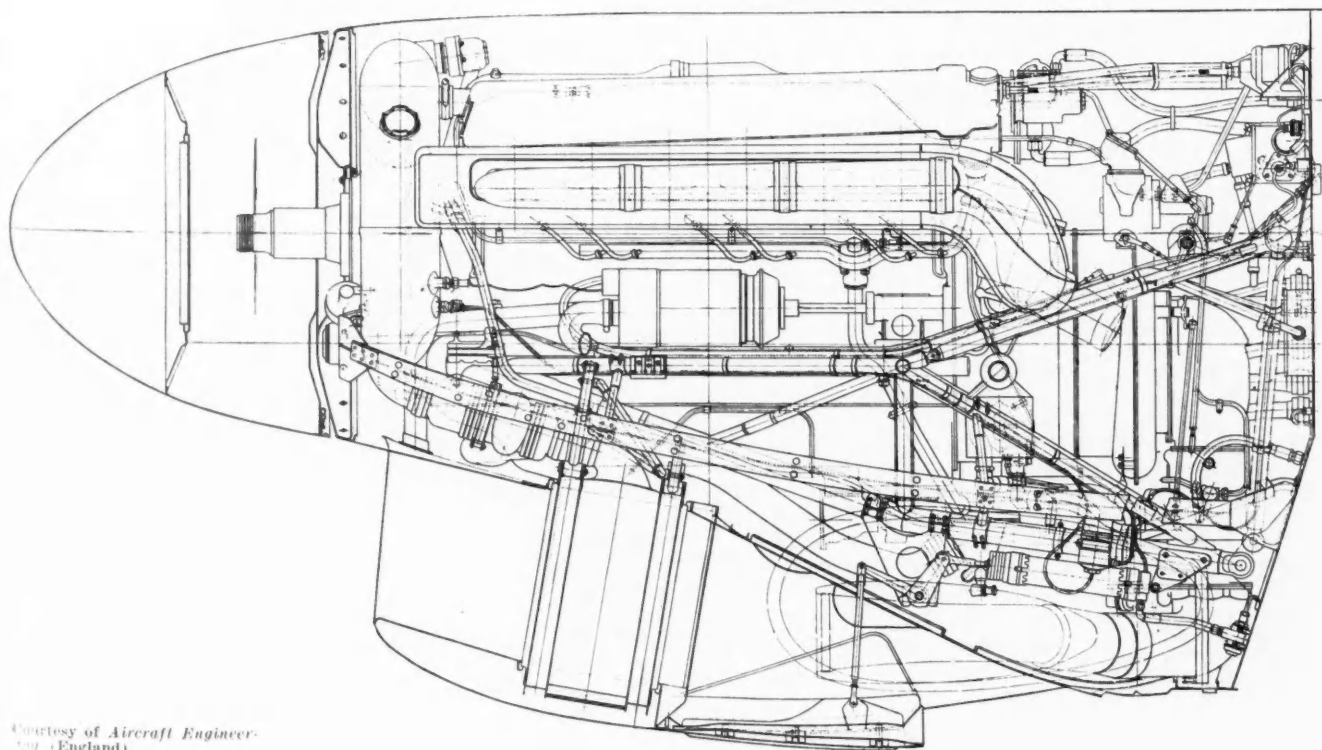
the one hand, has assurance that his product will be installed to the best advantage in such matters as mounting, cooling, oil cooling and so on, while the airframe manufacturer is relieved of responsibility and the need for research and experiment in such matters when preparing a new or modified type of machine for quantity production.

Not in all cases is the bulkhead supplied with the power unit, though it is standardized to the extent that not only are the fixing points common for liquid-cooled and air-cooled engines, but connections for pipes, electric couplings, and pneumatic and hydraulic controls are also arranged for interchangeability.

The latest Bristol Hercules power plant shown in the accompanying illustrations now has a maximum output of 1600 hp, with a piston displacement of 2360 cu in. The bore and stroke are $5\frac{3}{4}$ by $6\frac{1}{2}$ in. A cutaway view of the Hercules engine was published on page 29 of the Dec. 15, 1942, issue of *AUTOMOTIVE AND AVIATION INDUSTRIES*.

Ready-to-Fly Power Unit

The Merlin XX Ready-to-Fly Power Unit is being built by Rolls-Royce as a self-contained unit and is completely interchangeable with the Bristol Hercules Power Egg on the four-engined Avro Lancaster and two-engined Beaufighter.



Courtesy of Aircraft Engineer-
top (England)

The Hamilton-Whitfield Blower

A NEW positive-displacement type of blower, suitable for use as a supercharger, has been developed by the General Machinery Corporation, Hamilton, Ohio. It is similar to a Roots blower in that it comprises two rotors on parallel shafts, with intermeshing lobes, but it differs from the Roots in that the air flow, instead of being purely tangential, has an axial component. An advantage claimed for the new type of blower is that the air, instead of being taken in in slugs, is taken in and discharged smoothly through pockets which form between the rotors gradually, with the result that shock and noise are minimized. Of the two illustrations herewith the line drawing shows the direction of air flow through the blower, while the photograph shows the meshing of the rotor lobes and the sealing of the air pockets by the edges of the lobes.

The blower consists essentially of two helically-threaded members, rotatably supported within their casing on parallel shafts. Complementary threads of the two rotors are intermeshed to form a continuous sealing line over the full length of their engagement. The casing encloses both members in such a way as to seal their peripheral edges, and the only path through the blower is through the troughs of the treads. There are ports in the headers of the casing for the inlet and discharge. A pair of meshing gears on the rotor shafts outside the blower housing serve to maintain the rotors in their proper angular relation.

The larger, main rotor, which turns at drive-shaft speed, carries two right-hand helical threads, each of which advances 180 deg. from one end of the ro-

tor to the other. The smaller rotor, known as the gate, turns at one-half the speed of the drive shaft. It carries four left-hand helical threads, each of which advances 90 deg. from one end of the rotor to the other. Both rotor threads are symmetrical, generated forms. The sides of the main rotor thread are generated by the continuous edges of the helical thread on the gate rotor, while the troughs of the gate rotor are described by the edges of the crests of the helical threads on the main rotor. The combination of two threads on the main rotor with four on the gate rotor is said to result in optimum performance, giving the shortest sealing path, and overlapping pocket formations.

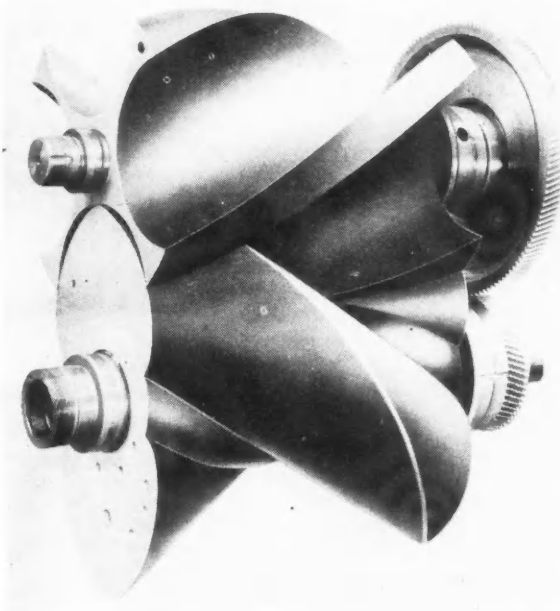
When the rotors are turned, the threads on them form and advance pockets along the grooves extending from one port to the other. If a housing is pictured as surrounding the rotors, sealing their peripheral edges, a clearly defined pocket is formed which moves in a direction depending on the direction of rotation of the rotors. Thus the blower can be operated in either direction; if a change in the direction of rotation is made, the inlet becomes the delivery port, and vice versa.

An interesting feature of the design is that the gate rotor is smaller in diameter than its normal pitch diameter. The hub of the main rotor is correspondingly larger than its pitch diameter. There is relative sliding motion between the two rotors, which is said to provide a self-cleaning action, so that no foreign matter can jam between them. The gate rotor, moreover, has practically no torque impressed upon it. Approximately 90 per cent of the power required to operate the blower is applied to the main rotor, and the timing gears transmit very little power.

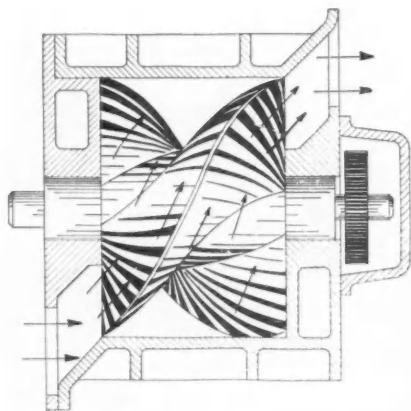
The casing is formed with one integral and one split removable head. The

rotors are supported in combined bearing and sealing assemblies secured to the shafts and carried loosely in the heads.

The ports of the blower are located diagonally opposite each other, on opposite sides of the plane including the axis of the rotors. They are formed partly in the heads and partly in the



Assembly of rotors with their timing gears.

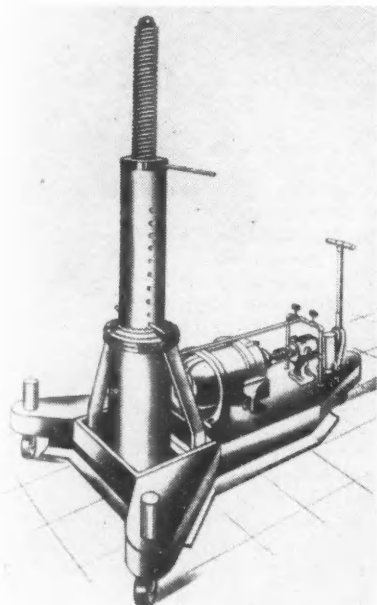


Section of Blower showing path of air through it.

side walls. The cycle of operation in a blower of this type depends on the angular width of the ports. If ports of considerable width are used, the blower will operate on a "rectangular-card" cycle; the pressure in a pocket then rises almost instantly from inlet to delivery pressure as the pocket is placed in communication with the delivery port, and drops back to inlet pressure when this communication ceases. If the ports are made narrower, the air in the pocket is compressed to the discharge pressure before the pocket communicates with the discharge port. When operating in this manner—on what is known as the "compressor cycle"—air in the discharge line is prevented from re-entering the blower and true adiabatic compression is closely approached. This not only increases the efficiency, but also tends toward a further reduction in noise.

(Turn to page 82, please)

New Products for Aircraft



Portable Hydraulic Airplane Lift
made by the Globe Hoist Company

A PORTABLE electric-hydraulic lift, for raising airplanes to free their landing wheels from the ground, is being built by the Globe Hoist Company, Philadelphia, Pa. While intended primarily for airplane service, inspection and maintenance operations in airports and hangers, the lift may also be used for assembly work in aircraft plants.

The power cylinder, which has an oil displacement of 7 gallons, is operated by means of a 5 hp. electric motor, direct connected to a 15-gallon-per-minute gear type pump. The lift provides a power rise of 27½ in., from a "down" position height of 50 in., plus a hand adjustment rise of 33¾ in. The top of the plunger is equipped with a half-ball socket to contact the plane's wing jacking pads, or it can be placed underneath the tail or nose section. Maximum lifting capacity is said to be 21,000 lbs., and the sustaining load capacity 63,000 lbs.

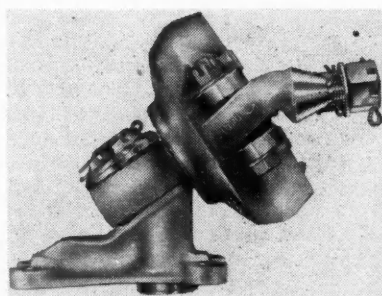
THE Snyder Tool Engineering Company, Detroit, Mich., is building a single-end horizontal machine for drilling and reaming aircraft parts. This machine is used to drill and ream a hole in the center of a boss on an aircraft part, the operation being performed before and after the part is welded into an assembly. The operation requires two special fixtures. The first fixture is used for drilling the side walls of the fork-like flange. Equalizing clamps are used to balance the stock

so as to bring the drill hole in the exact center of the boss. Guide bushings are provided in front of each side member.

After being drilled, the flange is welded to a tubular member, and the outside diameter of the tubular member is used for locating the assembly in the second fixture. The second fixture is equipped with a pivoted two-hole bushing plate; one set of bushings being employed for core drilling the holes on this assembly, and the second set of bushings for line reaming.

In operation, a bank of flanges is drilled, using the first fixture which is then replaced by the second fixture. The flanges are welded to the tubular member, placed in the second fixture, and core drilled and line reamed. A quick-change tool chuck is provided to permit fast exchanging of drill, core drill and reamer. Overall spindle speed may be changed through the use of pick-off gears. The coolant tank is in the welded steel base of the machine.

THE Type RS-40 Dynafocal Suspension, made by the Lord Manufacturing Company, Erie, Pa., is for use with the Wright 18 cylinder Cyclone engine. It was designed to provide isolation for all types of vibrational disturbances emanating from the engine and propeller. Excessive torsional movement is



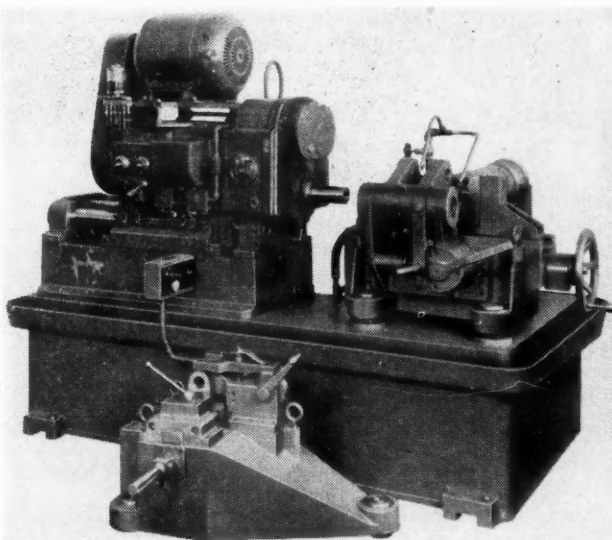
The Lord RS-40 Dynafocal Suspension
for Wright 18 cylinder engine.

restricted by a rubber snubbing ring, while excessive pitch and yaw are prevented by blocking out the action of the largest of the three ball joints beyond a predetermined degree. All snubbing action is cushioned.

The ball joints provide a small amount of damping, so that in passing through resonance, they will damp out excessive movement, and as they are in series with the rubber element any high frequency vibration, which might normally pass through the damping medium, is filtered out by the rubber element and not transferred to the airplane. A snap ring is used to facilitate replacement of the bonded rubber element.

(Turn to page 68, please)

Snyder Single-End Horizontal Drilling and Reaming Machine.



New Products

A New Water Soluble Masking Material

A masking material to protect floors, walls, work benches and other surfaces from paint, oil or grease, is being marketed by Turco Products, Los Angeles, California, under the trade name of Turco Duramask. This white, thick liquid which can be applied to floors or other surfaces with a brush, dries quickly to a hard, non-skid surface. When the accumulation of paint or other material is so great as to require its removal, the Turco Duramask can be dissolved with water and the paint film can be removed with a mop.

Flux for Gas Welding of Magnesium Alloys

A flux for gas welding of magnesium, known as "Mag-Na-Flo," is being offered by Park Stewart, Worthington, Pa. It is said to be suitable for gas welding all alloys of magnesium, whether sheet or extrusions. The flux



Welding Magnesium with Mag-Na-Flo Flux.

is used by mixing with water and painting on the metal to be welded. The welding rod should be coated by dipping it into the mixture of flux and water. Mag-Na-Flo flux is packaged in glass containers, and is available in a number of sizes ranging from ¼ lb. to 25 lb.

Vegetable Base Adhesives

A series of vegetable base adhesives is being sold by Paisley Products, Inc., Chicago, Ill., under the trade name "Vegimal." These adhesives are made

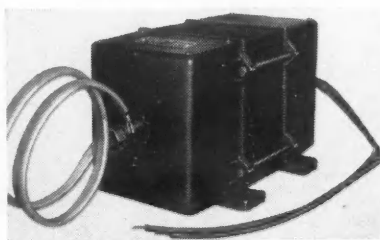
by conversion of domestic starches with plasticising chemicals added to produce various drying or setting speeds. At room temperatures, undiluted, the material is difficult to spread; heated to approximately 125 deg F, it liquefies and spreads to a gelatinous cohesive film. The film is instantly tacky, and remains so for considerable periods of time before drying, the length of time depending on the formation. Non-warping qualities, shrinkage of film, and duration of tacky state can be adjusted by amount of water dilution, thickness of film applied and temperature of solution.

Two New Products for Welding and Grinding

The Wolfe-Kote Co., Sheboygan, Wisconsin, announces two new products. Ever-Drest and Anti-Spatter. The makers claim that Ever-Drest lowers the surface tension of grinding wheel water, when added in the proportion of one pound to each five gallons of water, and adds to the life of the wheel as well as increasing its efficiency. Anti-Spatter is a material which can be applied with a brush to any metal that can be arc welded, and is said to prevent fusion of spatter and to eliminate practically all weld rust. It is also said to be non-inflammable and non-toxic, and to have no disagreeable odors.

Transformer Isolates Radio Interference

A special transformer has been developed by The Acme Electric & Mfg. Co., Cuba, N. Y., for testing radio and communication equipment. This Type T-4173 isolating transformer has its secondary winding completely enclosed in a copper shield to prevent radio interference which might otherwise enter a shielded test room by means of the power line. The manufacturer claims



Acme Type T-4173 Isolating Transformer.

The C-D Fog Fire Extinguisher is the newest product of The General Detroit Corp., Detroit, Mich. Being a carbon dioxide type extinguisher, it may be discharged safely on live electrical equipment, and is said to be very efficient in extinguishing fires in oil, grease or flammable liquids



that the transformer, rated at 2 KVA, is capable of handling an overload of 50 per cent, and that soldering irons, lights, instruments and test equipment may be operated from the shielded secondary without causing objectionable voltage drop.

Rubber-Fabric and Leather Substitute

A new material, Cottonleather, is a recent development of the Southern Friction Materials Company, Charlotte, N. C. It is a multi-ply fabric treated with chemicals to provide density and durability, and surface treated to give flexibility and leather-like nature. Cottonleather is available at the present time in sizes from 1 in. x 5/32 in. to 6 in. x 5/16 in., with one or both sides ground to a dense tan leathery surface. Available shapes include planks, strips, and rolls.

A WATERPROOF, protective mask for plastic glass bomber noses and windshields has been announced by Adhere, Inc., Los Angeles, Cal. This new material, "Spraymask," is applied with a paint spray gun, and afterwards may be peeled off in a sheet. The film is said to be tough enough to prevent abrasions and ordinary scratches during the assembly process as well as being resistant to paint for masking purposes. It is also said to have no chemical action on the plastic and to be impervious to paint thinners and ordinary solvents.

AUTOMOTIVE and AVIATION INDUSTRIES

Inland Reports

on Its First Year at War

AMERICAN INDUSTRY is all-out for Victory—has performed production feats that would have seemed impossible before Pearl Harbor. But we all know that the *real* accomplishments—ones that make ours worthwhile—are those of our men on the fighting fronts.

It is therefore humbly, and with full realization of this, that we report on what we have done—putting every ounce of skill and energy into backing up the men who fight for us!

1942 OUTPUT AT 102% OF CAPACITY. Inland maintained its production of "fighting steel" at about 102% of rated capacity during 1942, despite lack of an adequate supply of suitable scrap and the loss of hundreds of skilled workmen entering the armed services.

BREAK OVER 50 PRODUCTION RECORDS. More than 50 Inland production records have fallen since Pearl Harbor!

★ Open Hearth steelmakers in March had their best month in history.

★ The Blast Furnace Department hit its all-time production peak in the month of December.

★ Near the end of July the 76-in. mill finished enough ship plate in one 24-hour period for the hulls of two Liberty ships. All our mills rolling ship plate turned out enough in July for 34 Liberty ships—nearly half the number sent down the ways that month.

★ —And so on in other departments throughout the mills. Inland steelmakers are determined that our fighting men will not suffer for lack of steel they can supply.

★ Inland mines and quarries produced far more iron ore, coal and limestone than ever before.

★ Lake freighters in the Inland fleet broke their own cargo records, not once but several times in 1942.

EXPAND AND MODERNIZE FACILITIES. Not only has top production of steel with installed facilities been maintained, but we completed 27 major expansion and modernization projects to get even greater tonnage.

★ Inland's new No. 6 blast furnace, first one built in the Chicago area since Pearl Harbor, was blown in Nov. 16 and now is pouring out 1200 tons of pig iron a day.

★ We soon will complete construction of and begin operating two more blast furnaces for the Defense Plant Corp.

★ A new electrolytic tin plate plant will soon be in operation to conserve our precious stock of tin.

★ New ore mining expansion assures a larger supply of iron ore.

HELP TRANSPORTATION OF WAR GOODS. Reduced customer unloading costs 75%—improved packaging saved 40% of space—increased weights of carloading 36%—lowered car detention time 20%.

GETS IN THE SCRAP. Inland contributed heavily to the American Industries scrap campaign, conducted its own extensive scrap advertising campaign, and Inland salesmen are participating actively in the steel companies' industrial scrap drive.

EMPLOYEES ALL-OUT FOR VICTORY. More than 2,500 Inland workers have entered the armed services.

★ If medals were awarded to workers in war industries for effort "above and beyond duty," many men at Inland would qualify to receive them.

★ Women are helping carry on at the plant, too—doing a variety of jobs in the mills to help relieve the manpower shortage and maintain capacity output of steel.

★ The entire Chicago Heights plant and many departments at Indiana Harbor already are over the top in the current drive to put 10% of total pay into war bonds.

★ Inland girls have their own Red Cross group—making thousands of bandages. Nutrition groups are endeavoring to improve the general health of workers and fit them to contribute more to the war effort.

★ Many Inland employees are in the plants' own well-trained Catastrophe Organization, ready to meet any war-time emergency. Others are busy in civilian defense work, war group benefits, etc., and are sharing their cars, donating their blood and tightening their belts to do whatever else is necessary to win this war.

LOOKING AHEAD. As to the coming year, Inland and its men will continue to push the production of "fighting steel" at top speed. Rather than make predictions, we prefer to let production records speak for themselves. We know that we can pledge the whole-hearted support of every worker to all-out effort until Victory is won!

INLAND STEEL COMPANY

38 S. DEARBORN ST. • CHICAGO, ILL.

U. S. War Production Showed Great Increase During 1942

During November Munitions Were Produced at More Than Four Times the Rate at the Time of Pearl Harbor

Year-end news from the U. S. war production front has been good. Chrysler announced the production of more medium tanks in December than in the entire year 1941. Packard reported output of more than 1½ times the number of war engines, both marine and aircraft, in 1942 than the total Liberty aircraft motors manufactured by Packard in World War I, when it was the largest builder of that power plant. General Motors estimated its current armament shipments at nearly \$10,000,000 per operating day. Ford announced the full scope of its munitions program, ranging from four-engine bombers to Army truck tires. Donald M. Nelson reported that war production in November showed a 12 per cent increase over October, the greatest monthly gain since the rearmament program began in 1940. And George Romney, managing director of the Automotive Council for War Production, revealed that the automotive industry delivered armaments valued at \$4,656,000,000 in 1942, more than 10 per cent above the value of the industry's 1941 peace-time peak of civilian goods.

Packard's output of \$206,000,000 in 1942 was more than double the peak peace-time automotive year, according to President George T. Christopher. War goods represented 96 per cent of Packard's 1942 production compared to 30 per cent in 1941 and only 5 per cent in 1940. Daily production of Rolls-Royce Merlin aircraft engines and Packard marine engines for PT boats now equals \$1,000,000. December engine shipments increased 7 per cent over the previous month and 1943 schedules call for a doubling of production schedules, including engines for high altitude fighter planes. Addition of several large companies in the automotive, farm equipment and machine tool industries as subcontractors will help Packard expand its aircraft engine output this year. Already Packard subcontracts 50 per cent of the engine on a dollar volume basis and 80 per cent of the piece parts. The Rolls-Royce Merlin costs three times as much as the 1918 Liberty motor and involves three times the number of man-hours of labor.

Chrysler's production of M-4 tanks hit a new peak Dec. 28 when the tank arsenal turned out almost twice as many tanks as any previous day. December's total was several hundred tanks ahead of any previous month. Chrysler output of 40-mm. Bofors anti-aircraft guns, small caliber ammunition, marine tractors, gyro-compasses, tank engines and fire fighting equipment also hit new highs in December. Manufacture of Bofors guns exceeded the best previous month by 18 per cent. Production of Sperry gyro-compasses was in three figures. Chrysler multi-tank engine production which began in May, was almost double the best previous month. Fire fighting units assembled have now passed the 10,000-mark. Dodge trucks, which were de-

(Turn to page 58, please)

SAE Annual Meeting Held at Detroit

The annual meeting of the Society of Automotive Engineers, held in the Book-Cadillac Hotel at Detroit, Mich., Jan. 11 to 15, 1943, was transformed into an SAE War Engineering Production Meeting. The program was arranged so that all except one of the sessions were concerned with war-engineering problems. Many addresses were made by engineer-officers from the armed forces, and the exhibit was vir-

tually a display of war engineering. The meeting program was as follows:

Monday, Jan. 11; 10 A. M. and 2 P. M., Transportation and Maintenance. 8 P. M., Junior Student.

Tuesday, Jan. 12; 10 A. M., Military Vehicles Maintenance. 2 P. M., Ammunition and Artillery. 8 P. M., Business Session, announcement of election of officers. 8:30 P. M., Production.

Wednesday, Jan. 13; 10 A. M., Military Vehicles. 2 P. M., War Vehicle Materials. 6:30 P. M., Members' Dinner.

Thursday, Jan. 14; 10 A. M. and 2 P. M., Fuels and Lubricants. 8 P. M., Cooperative Research.

Friday, Jan. 15; 10 A. M., Diesel Cold Starting Symposium, closed session. 2 P. M., Diesel Superchargers.

A detailed report of the meeting will be published in the next issue of *Automotive and Aviation Industries*.

R. E. Gross Elected President of AWPC

Robert E. Gross, president of Lockheed Aircraft Corp., was elected president of the Aircraft War Production Council, Inc., to succeed Harry Woodhead, president of Consolidated Aircraft. LaMotte T. Cohu, chairman of the board of Northrop Aircraft succeeded Mr. Gross who was vice-president of the Council.

Mr. Woodhead reported that 10,200 materiel exchanges have been accomplished by the member companies as part of their program of cooperation for greater production of fighting airplanes. In addition, the member companies have made 1075 exchanges of technical engineering information.



The Consolidated C-87

The Consolidated transport, powered by four high-speed engines, is an adaptation of the famous Liberator bomber. It is said to be capable of carrying the greatest human or cargo load of any airplane now in mass production.

Thorough cleaning means longer lathe service



Information supplied by an Industrial publication

In cleaning lathes it is common practice to brush chips, dust, and dirt off lathe ways and surfaces, spindle threads, and other obvious places.

There are other parts where cleaning is equally important, but that are likely to be overlooked. One is the lead screw, and the other is the interior threads in the chuck or face plate back.

The former can be effectively cleaned by holding a cord, or piece of twine of suitable diameter in the

thread groove, and pulling the ends back and forth as the screw revolves. The motion is similar to that used in polishing shoes.

Interior threads can be cleaned by a simple tool made out of a piece of heavy steel wire. The wire is bent into a loop, with the ends bent at right angles. The tool works better if the ends are filed to the V-shape of the threads, the spring in the loop will hold the ends tightly in the thread grooves.

CLIMAX FURNISHES AUTHORITATIVE ENGINEERING DATA ON MOLYBDENUM APPLICATIONS.
MOLYBDIC OXIDE BRIQUETTES • FERROMOLYBDENUM • "CALCIUM MOLYBDATE"

Climax Molybdenum Company
500 Fifth Avenue • New York City

WLB Authorizes 10 Regional Offices to Settle Labor Disputes

Hopes This Decentralization Will Expedite the Handling of Many Cases Still Unsettled

A recent epidemic of wildcat strikes and work stoppages in automotive war production plants is partly attributable to the fact that the mediation machinery of the War Labor Board has broken down under the weight of the many cases that have been referred to the board in recent months. The WLB closed only 296 cases out of 2119 accepted between Jan. 12 and Nov. 30, and only 40 out of 699 referred to it in November had been disposed of near the end of December. Prolonged deferment of WLB decisions has been the cause of many of these walkouts, as the workers became dissatisfied with the long delays. Officials of the UAW-CIO and the AFL have joined with Michigan manufacturers' groups in urging the WLB to expedite its decisions.

Vesting of authority with the 10 regional offices of WLB to settle labor disputes and to approve voluntary wage and salary adjustments involving more than 100 workers has been delegated by the board and this decentralization may help remedy the situation. Under this policy the 12-man board in Washington will hear appeals from regional decisions and reserves the right to take original jurisdiction in cases of national importance. Panels composed of management, labor and public representatives will take over disputes which the U. S. Conciliation Service cannot settle. The panels will make recommendations to the eight-man regional advisory boards which will then make final decisions, subject to review and

appeal. Detroit, the largest center of war production which has been the scene of many recent work stoppages, has to clear its labor disputes and get wage raise approvals through the Cleveland regional office, and this has further impeded the settlement of these disputes.

The first local WLB panel to hear a dispute in Detroit is the three-man body named for the contract renewal controversy between Chrysler Corp. and the UAW-CIO. Wage issues in this contract were settled by a WLB decision of Oct. 3 granting a four-cent per hour general increase, but the main body of the contract expired Nov. 29. The dispute was certified to the WLB Dec. 11 after Chrysler objected to union demands for the closed shop and checkoff. The UAW-CIO has reduced its original demands from 99 to 68. T. J. Donahue, chairman of the Michigan State Labor Mediation Board, is chairman of the three-man WLB panel.

The WLB took a strong stand in one recent Michigan strike when it declined to order reinstatement of seven members of the Mechanics Educational Society of America at the Briggs Mfg. Co. Conner Ave. plant at Detroit and condemned Matthew Smith, national secretary of the independent union, for "highly irresponsible and reprehensible" actions in calling a sympathy strike Nov. 7 at 15 Michigan war plants involving 9000 workers. Smith sought through the strike action to force the WLB to assist the MESA in negotiat-

ing with the Briggs management, which holds an exclusive bargaining contract with the UAW-CIO. The MESA had sought to organize Briggs maintenance workers by capitalizing on the WLB decision of Oct. 27 which denied a general wage increase to maintenance and construction workers in automotive plants. The seven MESA members were ejected from the Briggs plant in an altercation after they sought to recruit other workers in the MESA on the premise that that union had not made any "no strike" pledge during the war emergency. Smith admitted before a five-man WLB panel that he called the strike to obtain action from the WLB, acknowledging that the board has been slow to act in many disputes.

Two recent work stoppages in Detroit have brought the intervention of the Army Air Forces. A one-day wildcat strike of 800 maintenance workers at the Ford Rouge plant made 11,000 other employees idle and cost 113,000 man-hours of war production, mostly in the foundries. The maintenance men struck in protest at a company order assigning them to particular buildings rather than on a plant-wide basis. They said they feared loss of seniority. Local 600 of the UAW-CIO ordered the men back to work but they did not return until Col. George Strong, of the AAF, issued a statement saying, "Ford workers who refuse to return to work and to cooperate in the war effort may not have the opportunity in the future to be engaged in war work." In a slowdown at the Buick foundry in Flint last summer, two shop committeemen responsible for it were suspended indefinitely from working there by the War Dept. through Col. Strong but the ban was lifted Dec. 5. The men have appealed through the GM umpire for return to their jobs.

Unauthorized work stoppages that shut down plant No. 1 of the Bohn Aluminum & Brass Corp. three times in four days, making 1200 idle, brought a warning from Col. Strong of drastic action and the men returned to their jobs. The plant makes parts for airplane engine manufacturers. The walkouts were in protest at the failure of the WLB to act upon a wage raise agreed upon Oct. 29 by the company and the UAW-CIO. Two wildcat strikes of 120 employees in the dynamometer test department of Chrysler Corp. tied

(Turn to page 60, please)

Four Plane Firms Finance Laboratory

A laboratory being constructed by the California Institute of Technology, will be financed by Consolidated Aircraft Corp., Douglas Aircraft Co., Lockheed Aircraft Corp. and North American Aviation, Inc. Included in the equipment will be a wind tunnel for testing scale models of airplanes at speeds up to 700 miles per hour. The cost of the laboratory will be approximately \$2,000,000.

AUTOMOTIVE and AVIATION INDUSTRIES

Lehigh University News Bureau

Bethlehem, Pennsylvania

Release Date

Horseless Age periodicals
mailed Dec. 24

DEC 28 1942

Bethlehem, Pa.--The first periodicals ever published which dealt exclusively with the automobile are among the 950 rare volumes which were given to the Lehigh University library by Curtis H. Veeder, of Hartford, Conn., a member of the class of '66.

This set of periodicals--25 volumes were included in the gift--was published under the title of "The Horseless Age."

###

Horseless Age, Founded in 1895, was combined with Automotive and Aviation Industries in 1918.

THROUGH TWO WORLD WARS



...AND AFTER!

FORM-A-GASKET NUMBER 1
 FORM-A-GASKET NUMBER 2
 AVIATION FORM-A-GASKET
 GASKET CEMENT
 INDIAN HEAD GASKET
 SHELLAC COMPOUND
 HYDRAULIC BRAKE FLUID
 TOON-OYL
 PENETRATING OIL
 RUBBER SHACKLE
 LUBRICANT
 VALVE GRINDING
 COMPOUND
 NON-DRYING
 PRUSSIAN BLUE
 KNEE ACTION OIL—
 SHOCK ABSORBER OIL
 SHOCK ABSORBER FLUID
 ENGINE ENAMELS
 PIPE JOINT
 CEMENT
 PERMA-LUSTRE
 CLEANER-POLISH
 WAX POLISH
 BLUE-BLAZES SPEED WAX
 REFLECTOR-CHROMIUM
 POLISH
 FABRIC CLEANER
 LIQUID
 RADIATOR CEMENT
 DOUBLE ACTION
 RADIATOR CEMENT
 INDIAN HEAD
 RADIATOR CEMENT
 RADIATOR CLEANER
 FORM-A-WELD
 GLASS SEALER
 ANTI-STORM BLACK
 TOP DRESSING
 AUTO TOP SEALER
 TAROFF

Permatex Chemical Research and Production keep abreast or ahead of the ever changing conditions of war.

In the Automotive, the Aviation and Industrial Industries . . . Permatex Marches On!

PERMATEX COMPANY, INC.

Sheepshead Bay, N. Y., U. S. A.

One of the large transport gliders being used by the Airborne Divisions of the Royal Air Force, now reported in use in the African campaign.



Acme

Students Eligible for Lincoln Scholarship

The James F. Lincoln Arc Welding Foundation's new project, the \$6,750 Annual Engineering Undergraduate Award and Scholarship Program, is open to all students in all departments of engineering. The object, as expressed in the rules and conditions governing participation, is "to encourage engineering students to study arc welded construction so that their imagination, ability and vision may be given opportunity to extend knowledge of this method and thus aid the war effort and the economic reconstruction in the peace which is to follow." The Foundation states that a technical knowledge of arc welding is not required, and that the necessary back-

ground can be acquired by any student in a few hours of reading.

British Engineers Visit U. S. Plants

A special British aircraft engineering mission has arrived in this country at the invitation of the United States government, to confer with American aircraft officials and producers on co-ordination of American and British technical practices and design. The mission, which is headed by Sir Roy Fedden, special adviser to the Ministry of Aircraft Production, will tour representative American aircraft and engine plants. Their visit is under the auspices of the U. S. Army Air Forces, the U. S. Navy Bureau of Aeronautics, the Civil Aeronautics Board and the W.P.B.

tails. Steel plates sharply top the list of urgently needed steel products, but this condition is expected to become less acute when additional rolling capacity becomes available late in the Spring. Given the necessary basic steel, sheet rolling and finishing mills, that formerly depended for their support almost entirely on orders from passenger car manufacturers, could add considerably to their production, especially so cold-finishing specialists, but war demand for sheets runs relatively light. Some of the smaller steel mills have considerable trouble in getting sufficient labor, both unskilled and semi-skilled.

What amounts to a renewal of the International Tin Control Agreement, which was in operation from the beginning of 1937 to the end of 1941, has been signed in London by representatives of the governments of Belgium, Bolivia, the United Kingdom and the Netherlands, but while in pre-War years the objective of this pact was to prevent tin becoming a glut in the world's markets and to apportion the burden of restricted output equitably among the signatories, its aim now is to supply the United Nations' war needs in spite of the Japanese occupation of the Malay States and the Netherlands Indies. It is significant that, although for the time being there is little need of promoting the use of tin through research and publicity, these activities are to be continued with undiminished energy.

Plain Carbon Steels Replacing Alloy Steels for Many Uses

*Steel Demand Continues to Exceed Capacity Output
Battlefield Scrap to Be Collected Wherever Possible*

By W. C. HIRSCH

Steel market authorities are of the opinion that alloy steels are still being used in many parts in which plain carbon steel, properly heat-treated would serve as well, and the War Production Board is giving active support to the broadening of the uses of the so-called Emergency steels by facilitating test runs through the sanctioning of small lot shipments without regard to preference ratings. In not a few uses, for which "fat" alloy steels were formerly thought to be indispensable, it was found that plain carbon steels could be substituted without in any way impairing the performance of the finished assembly, and this achievement acts as an incentive to further efforts in the same direction. Not only are procurement officers of the armed forces taking a more realistic attitude with reference to the limitations in the supply of many metals, but, according to

Washington reports, the necessary machinery is being set up to add considerably to the supply through the systematic collection of battlefield scrap under competent ordnance personnel, wherever in the war theater this becomes possible. Scrap, so collected, can be advantageously transported to the United States in cargo vessels taking army supplies on their outward trip.

What trifling loss in steel mill output was caused by floods in Pennsylvania and Ohio and by the Christmas holiday has been made up for by capacity production in the first half of January. Damage to furnaces and other equipment by floodwaters was light and repaired in a few days. Over-all steel demand continues to run ahead of capacity output, unaffected by the suspension here and there of small ordnance requirements resulting from minor adjustments of war strategy de-

New Majestic Plant

The Majestic Company, Huntington, Ind., has recently put into operation a new plant, located in the same city, equipped for producing aluminum castings by a special permanent mold process. The new company will be known as The Majestic Aluminum Company. The new process being used is said to produce castings of high tensile strength and fine finish. Alloys used in this process are heat treatable, and the company is equipped to handle the required heat treating. The plant is at the present time operating at capacity on aircraft work.



Making America's fire-power *"FAST ON ITS FEET!"*

War takes more than man-power and fire-power today. *It takes horse-power, by the billion! All kinds of horse-power! Some for lightning speed—some for sheer irresistible "oomph"—some for steady, hour-in-and-hour-out pulling at full load.*



In bomber and fighter plane engines, in army trucks, tractors, tanks, jeeps, motorcycles; in submarines, torpedo boats and destroyers, Sealed Power Piston Rings are saving fuel and oil that become precious beyond price, after being carried perhaps half-way 'round the world.

SEALED POWER CORPORATION

Muskegon, Michigan • Windsor, Ontario

**BUY
MORE
WAR
BONDS**

PISTON RINGS—PISTONS—CYLINDER SLEEVES

MEN

K. D. Smith, formerly manager of the B. F. Goodrich Co. national sales and service division Washington office, has been assigned to Detroit as military liaison representative with the Ordnance Dept. Tank-Automotive Center.

Frank A. Mickle, associate professor of mechanical engineering at the University of Michigan, has been commissioned a lieutenant-colonel and appointed chief of the simplification section, Development Branch, of the Tank-Automotive Center at Detroit. He will endeavor to standardize design and simplify production, maintenance and supply of spare parts through a reduction of

the basic types and sizes of vehicles, the number of variations between vehicles of the same basic size and type and the diversity of components and accessories used on the different types and sizes of vehicles.

Donald U. Bathrick, on leave as general sales manager of the Pontiac Motor Division, has been named head of the Washington office of General Motors. He succeeds **Richard H. Grant**, GM vice-president, who will return to his former duties in Detroit and also will continue to supervise activities of the Washington office.

William C. Carter, formerly executive vice-president, has been elected president of the Link-Belt Co., succeeding **Alfred Kauffmann**, who resigned because of ill health.

Edward C. Wells, assistant chief engineer of the Boeing Aircraft Co., has been awarded—
(Turn to page 67, please)

**"IT'S NOT IMPORTANT
UNLESS IT WILL HELP
WIN THE WAR."**

**MISTER,
you said it!**

This is no time for "hair-splitting" or "gingerbread". Chrome trim and plaid upholstery don't fit in with tank-killer turret guns and caterpillar treads.

And how important anything is must be measured in terms of "service rendered" where it counts most.

Our product, the **VISCO-METER***, built up quite a service record in government use through pre-war years. Soon after Pearl Harbor our entire production capacity was enlisted to serve with the gasoline and Diesel engines consigned to Uncle Sam's war uses.

A simple 12 ounce piece of mechanical precision the **VISCO-METER*** is doing an important job—and doing it

well—guarding these needed and costly engines against lubrication failures. No need to go into the importance of lubrication—that's recognized. The important thing is: only **VISCO-METER*** can tell visually, (via a continually indicating gauge) the viscosity or lubricating value of the crankcase oil while the engine is in operation. Only **VISCO-METER*** can warn in advance of failure—preventing damage and loss of service. So the **VISCO-METER*** is important and is helping to win the war.

In peacetime the **VISCO-METER*** will continue to play an important role. If you are looking forward, a **VISCO-METER*** engineer can be most helpful.

VISCO-METER

CORPORATION

GROTE ST., BUFFALO, N. Y.

*Fully covered by U. S. and Foreign Patents

Business in Brief

Written by the Guaranty Trust Co., New York, Exclusively for AUTOMOTIVE AND AVIATION INDUSTRIES

Approximately stability of general business activity continues. The seasonally adjusted index of *The New York Times* for the week ended Dec. 26 stood provisionally at 136.6 per cent of the estimated normal, as compared with 135.5 for the preceding week and 137.1 a year ago. The index of *The Journal of Commerce*, without seasonal adjustment, for the same period dropped, under holiday influence, to 114.3 per cent of the 1927-29 average from 130.1 a week earlier.

Department store sales during the week ended Dec. 26, as reported by the Federal Reserve Board, were 15 per cent above the corresponding level in 1941, as compared with a similar excess of 10 per cent shown for the week before. For the period of four weeks then ended, the total was 13 per cent greater than a year ago.

Railway freight loadings during the week ended Dec. 26 totaled 591,595 cars, as compared with 742,911 cars in the preceding week and 606,502 cars a year earlier.

Electric power output during the same period, according to preliminary reports, was 13.6 per cent greater than a year ago, as against a similar excess of 13.8 per cent shown for the week before.

Crude oil production in the week ended Dec. 19 averaged 3,891,500 barrels daily, 10,350 barrels above the figure for the preceding week but 124,400 barrels less than the average output recommended by the Petroleum Administration for War.

Average daily production of bituminous coal during the week ended Dec. 26 was 1,609,000 tons, as compared with 1,913,000 tons in the week before and 1,620,000 tons a year ago.

Engineering construction contracts awarded in the final week of 1942 totaled 39 per cent more than the preceding year-end figure, according to *Engineering News-Record*. The total for the entire year is 56 per cent greater than the figure for 1941—with public work showing a rise of 83 per cent, as against a drop of 54 per cent in private contracts.

Professor Fisher's index of wholesale commodity prices for the week ended Dec. 31 rose to 109.8 per cent of the 1926 average from 109.6 a week earlier, as against 101.2 a year ago.

Member bank reserves declined \$341,000,000 during the week ended Dec. 30 and estimated excess reserves declined \$530,000,000 to a total of \$1,660,000,000. Business loans of reporting members fell \$7,000,000 in the same period and stood \$654,000,000 below the total a year earlier.

CALENDAR

Conventions and Meetings

Eleventh Annual Meeting of the Institute of the Aeronautical Sciences, New York City, Detroit and Los Angeles Jan. 27, 28 and 29
Midwest Power Conference, Chicago April 9 and 10
American Foundrymen's Association, St. Louis, Annual Meeting . . . April 28-30



**ABLE TO TAKE IT--
ON THE BATTLE LINE**

**ABLE TO TAKE IT--
IN THE TOOL ROOM OR
ON THE PRODUCTION LINE**

Built to "dish it out" and take it, too, Uncle Sam's tanks demand tough materials and skilled design to give them stamina and striking power.

The same principles hold for milling machines—the machine tools that are mighty important in building tanks and other weapons. In tool room or on the production line, milling machines must be built to perform at a record-breaking pace and maintain close tolerance-accuracy in operation.

The center bearing on the spindle of Milwaukee Milling Machines reduces by one-half the distance between bearings — *increases rigidity eight times!*

Ask the man at the controls of a Milwaukee — he can tell you how important this center bearing is (in addition to the husky column) in providing built-in rigidity and all that it means in sustained accuracy — longer cutter life — smoother performance at all speeds and feeds.



KEARNEY & TRECKER
CORPORATION
MILWAUKEE, WISCONSIN



Milwaukee

M A C H I N E T O O L S

Buy Victory with at least 10% in War Bonds!

Copolymer Corp. to Operate New Plant

Secretary of Commerce Jones has announced that Rubber Reserve Company has made a contract with Copolymer Corporation to operate a new government-owned synthetic rubber plant which is to be built in Louisiana by Defense Plant Corporation. The seven independent rubber companies participating in ownership of Copolymer Corporation are Armstrong Rubber Company, Dayton Rubber Manufacturing Company, Gates Rubber Company, Lake Shore Tire and Rubber Company, Mansfield Tire and Rubber Company,

Pennsylvania Rubber Company, and Sears, Roebuck and Company. These companies will furnish an experienced technical staff for management of the new plant.

War Workers' Need Of Tires Stressed

The importance of providing adequate tires for war workers was emphasized in a recent release by the Public Roads Administration, which declared that a majority of cars used by workers in 12 Southern and Midwest war plants would be forced off the road



A General Electric portable forced-convection heater in the guard house of a defense plant. It was designed for heating small rooms located at a distance from central heating plants.

PHOTO BY U.S. ARMY SIGNAL CORPS.



STERLING PISTONS STAND THE PUNISHMENT OF COMBAT

Tanks, planes, trucks, reconnaissance cars, marine engines, and other mobile combat units must stand any kind of punishment, any time and place they are called to battle. Whether it's in a blazing desert sandstorm or the frigid temperatures of the Arctic, a motor in battle *must* not fail.

That's tough service for motors and pistons — but thousands of these motors are equipped with Sterling Pistons.

STERLING ALUMINUM PRODUCTS
Incorporated St. Louis, Mo.



STERLING

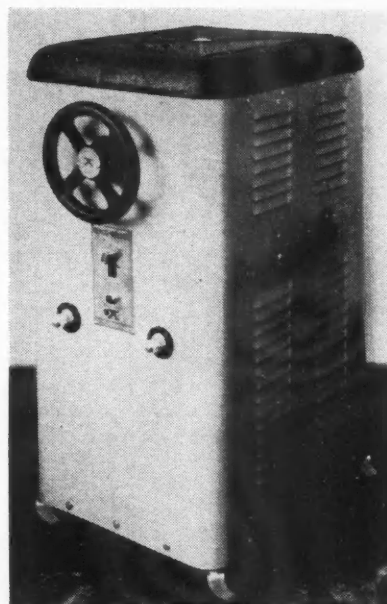
PISTONS

by next summer unless tires are recapped or replaced before that time.

It was also revealed by the study that the majority of workers in the plants travel to work by automobile. However, studies made by the Highway Traffic Advisory Committee to the War Department show that workers are not giving "adequate consideration" to walking and to group riding.

Herco Arc Welder

HERCULES ELECTRIC & MFG. CO., INC., Brooklyn, N. Y., is offering a new line of variable core Herco arc welders. Variable core construction permits stepless heat changes by turning the control wheel. The heat control may be changed while the machine is operat-



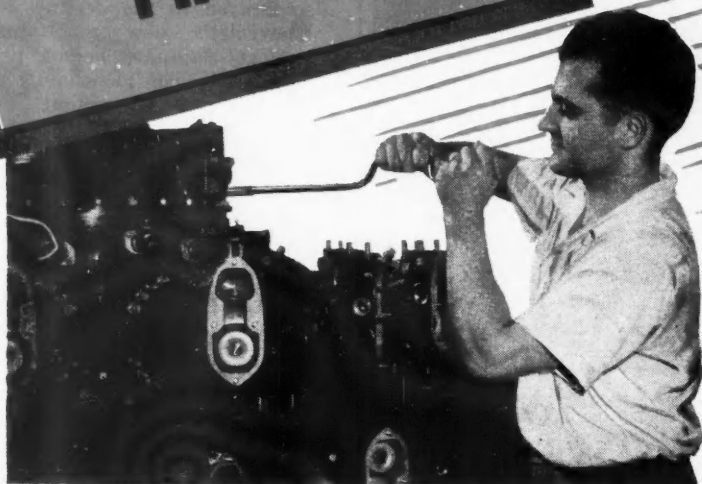
Herco Variable Core Arc Welder

ing. Spun glass insulation is used, and these welders are said to be capable of continuous operation without overheating or damage. Five models are being built, the smallest having a range of 25-150 amp. and the largest a range of 100-625 amp.

**WHERE
CYCLONES
ROLL DOWN
THE LINE...**



**Snap-on
Tools**



**HELP SPEED DISASTER
TO THE AXIS!**

VICTORIOUS POWER for America's Flying Fortresses...and for many another potent warplane . . . down the long assembly lines at Wright Aeronautical Corporation roll the mighty Cyclone "9s"! Here's bad news in big volume for the Axis everywhere!

On Wright's powered assembly lines high production is accompanied by *high precision* . . . and swift, efficient Snap-on Wrenches play an important part. Many of these Snap-on Tools are specially made or adapted for operations on the line.

The accuracy, flexibility and solid power of Snap-on Wrenches lend extra speed and pre-

cision to difficult jobs. From production and assembly line to maintenance shop and far-flung bomber base . . . wherever ships are built and flown and serviced . . . Snap-on Wrenches and Hand Tools have demonstrated their exceptional fitness for aviation's needs. Snap-on's 3,000 tools and direct-to-you service are conveniently near you through 35 factory branches at key aviation centers throughout the United States and Canada. For catalog, write —



**SNAP-ON TOOLS
CORPORATION**

8054-A 28th Avenue Kenosha, Wis.

War Production Increases During 1942

(Continued from page 48)

livered to the Army as early as 1939, now number more than 200,000 with the armed forces. Other Chrysler war products include Martin B-26 bomber fuselage sections and wings by DeSoto, aircraft landing gears by Plymouth, Navy pontoons, air raid sirens, field kitchens and marine engines.

Ford's complete list of war products revealed that the company is manufacturing turbo-superchargers for bombing planes. Ford also is operating its own armor plate mill to produce steel for tanks and planes. The new

aluminum and magnesium foundries, providing parts for aircraft engines and B-24 bombers, both built by Ford, also are in production. Ford engineers simplified the 75-mm. gun mount for the M-4 tank which the company is making. Previously composed of 27 fabricated parts, the gun mount has been reduced to three forgings. Other Ford products include jeeps, transport gliders, low silhouette Army trucks, tank, truck and jeep engines, and laminated glass for combat vehicles. The Defense Plant Corp. recently

authorized more than \$6 million in additional expenditures for Ford plants and equipment. A new contract for facilities in Michigan in excess of \$1 million was approved, together with more than \$5 million for machinery and equipment in Ford plants in Michigan, New York and Ohio. DPC commitments with Ford now exceed \$39 million.

About one-third of General Motors' war projects are now operating at the capacity rate, according to President C. E. Wilson. By the close of 1943 he expects all GM war projects to attain their capacity rate or the needed rate of production. GM war shipments in November totaled \$247,685,749. This marked a decrease of \$719,811 from the previous month but the fact that November had two less working days probably was responsible for the drop, although shifts in government schedules and renegotiation of contracts also figured in the decline.

Chevrolet's new aluminum forge plant at Saginaw began production Dec. 5, just seven months after ground was broken. This plant, added to current output, will make Chevrolet one of the largest suppliers of aluminum aircraft forgings in the U. S. The new plant's production began with aluminum propeller blades and propeller piston forgings, but main crankcase sections, pistons and other aviation forgings for Pratt & Whitney engines, built by Chevrolet, will be added. The new forge plant includes four 35,000-pound steam hammers and a press capable of exerting 6 million pounds pressure for pre-working aluminum stock. Fisher Body will become one of the largest suppliers of gun breech housings for Navy anti-aircraft guns under the terms of a new contract. This will require use of a Detroit plant, which was the first in the automotive industry to win the Navy "E", and additional facilities in another large plant. Approximately 40 per cent of the machines needed are available, but \$4,000,000 worth of new equipment will have to be obtained. Monthly output of the gun parts will be 10 times the original rate at which Fisher turned them out.

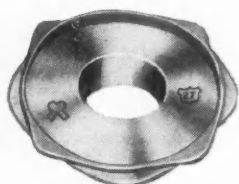
Eastern Aircraft Division of GM, which was formed Jan. 21, 1942, is the first unit of the automobile industry to convert former automotive facilities to the production of complete airplanes. The new division utilizes some 60 acres of floor space in five former GM parts and automotive assembly plants in the East for the manufacture of German FM-1 Wildcat fighters and TBM-1 Avenger torpedo bombers for the Navy. The plants converted are former Fisher Body plants at Baltimore and Tarrytown, N. Y., a Delco-Remy battery plant at Bloomfield, N. J., a Ternstedt automotive hardware plant at Trenton, N. J., and a plant at Linden, N. J., where Buicks, Pontiacs and Oldsmobiles were assembled.

(Turn to page 60, please)

ETCHING STAMPS for CODE MARKING NOW MADE IN AN

Amazing New Material

Results of tests in actual production have shown that Matthews new "S-22" Synthetic outlasts the best rubber or other synthetic stamps from three to four times! The new "S-22" Synthetic is unaffected by acid etching inks.



Part marked with code symbols, by means of etching stamps. Hundreds of symbols to choose from.



Etching stamps are widely used for inspection stamping of metal parts and assemblies. Made in various styles to suit your marking application. The popular Peg & Pin Style illustrated is used where large volume inspection stamping is required.

Write for Bulletin S-Catalog 146

This valuable leaflet illustrates and describes the various styles of stamps available in the new "S-22" Synthetic. Write for your copy today!

JAS. H. MATTHEWS & CO.

3973 Forbes Street

Branch Plants

NEW YORK
CHICAGO
PHILADELPHIA

BOSTON
NEWARK
SYRACUSE



Pittsburgh, Pa.

District Sales Offices

DETROIT
CLEVELAND

HARTFORD
BIRMINGHAM



CAN YOU *Hear* WEAR?

You bet you can . . . every mechanic knows that noise is almost certain to mean wear—especially is this true of gears. Unless gears are “mated”—accurately matched to a perfect mesh—they fight each other and noise is a natural consequence—extra wear certain.

Fuller Transmissions are quiet. Note how smoothly you can shift from one speed to an-

other. The driver doesn't have to “fight the gears” or learn tricky shifts. It makes his job a lot easier—reduces fatigue—and most important of all assures longer gear life.

Let your truck dealer tell you why

Fuller Transmissions are standard on so many nationally recognized trucks.



FULLER MANUFACTURING COMPANY • KALAMAZOO, MICHIGAN

Conversion of these former automotive plants to aircraft manufacture took about three months, during which time more than 12,500 tons of tools, machines, fixtures and equipment were removed. Seventy-seven of the 134 machine tools at the Linden assembly plant were converted for airplane manufacture but this was less than 10 per cent of the 1,000 machines needed there. Less than 250 of 1,000 automotive machine tools at the Trenton plant could be utilized. Only 30 of the machines at Bloomfield were adaptable for aircraft manufacture. The roof of the Linden plant had to be raised 26 feet over the final assembly

bay to accommodate the plane assembly operations.

President Wilson, of GM, aptly described the Eastern Aircraft Division's operations when he said, "I think the Linden and Trenton plants have hit a very happy compromise on production methods and procedures that can be used effectively in the production of airplanes. They have taken what was good from the aircraft industry, and they have taken what was good from our experience in the automobile business."

Wilson pointed out that the assembly lines are a very small part of the automotive industry's mass production

technique. Such technique begins with accurate specifications of the material, accurate drawings, accurate and careful inspection and gages so that the pieces are interchangeable. This also enable employees to be taught quickly to do a particular repetitive operation. Due to the fluid design of aircraft, with frequent changes that may require an alteration in as many as 6,000 operations for a single change, Eastern has established a Change Dept. to control purchasing and prevent stockpiles from becoming overloaded with parts that might have to be scrapped on short notice. The tooling policy also varies radically from automotive procedure. It has been proven much more rapid and economical to tool "lightly" for aircraft manufacture due to the continual design changes. Expensive investments in fine steel dies and special machine tools such as brought lower cost and mass production in the automotive industry, are superfluous. General purpose machines and rough but accurate dies are much more useful.

Nelson's report of the 12 per cent advance in November munitions production showed the WPB munitions index at 431 as of Nov. 30, indicating production was running at 4 1/3 times the rate at the time of Pearl Harbor. Airplane output gained 18 per cent in November, ordnance was up 13 per cent and other munitions 9 per cent. Single-engine fighters, Navy fighters, medium bombers and smaller transport planes all showed sizeable production increases in November. Army ground guns and self-propelled guns also showed marked advances.

TASK FORCE WITH A



Faster, Better, at Lower Cost!

Bite into the huge aviation war production job almost any place where thousands of feeder factories have taken hold of their parts of the job and you'll find that our strength in the air is growing in leaps and bounds because someone found a shortcut to Berlin with better materials and methods.

Among the Task Forces being concentrated to reach our objective of producing ENOUGH . . . IN TIME are McAleer finishing materials and methods. Engineered to meet the production finishing requirements of today, these Quality-Controlled buffing and polishing compositions are helping set new finishing standards in representative plants from coast to coast.

To cope with the demand for speed and more speed—you need, more than ever before, the specialized services McAleer offers. Less waste through elimination of rejects, greater output and low operating costs are the orders of the day in all war-time production finishing.

The battle begins here—let's fight and work together!

McAleer

MANUFACTURING CO.

Quality-Controlled Finishing Materials
ROCHESTER, MICHIGAN

Regional Office to Settle Labor Disputes

(Continued from page 50)

up the production of tank engines and threatened to close the Chrysler tank arsenal until the men returned. They were protesting the failure of the company to meet the wage rates of other companies for similar work.

The new job stabilization plan instituted by the War Manpower Commission in the metropolitan Detroit area has cut labor turnover in war plants to less than 1 per cent a month, if the number of applications for job changes in the first month of operation are any criterion. Previously the monthly turnover rate has ranged from 3 to 25 per cent per month, depending upon the length of service of the employees.

In the first month of the plan, the U. S. Employment Service was notified of 3290 job quits in essential occupations. Of this number, 1156 were granted releases by their employers to change jobs for valid reasons and 1392 quit their jobs and were released by their employers to seek jobs elsewhere. Two hundred and eighty cases involved workers from other cities, while 462 appealed to the USES when they were refused transfer releases by employers.

The Challenge of the Present . . . and the Promise of the Future!

THESE are challenging days in which to live and work—and America has met the challenge. Week by week, the people of this country are proving that they can make sacrifices and ignore discomforts. And industry has met the challenge by pooling its knowledge and resources, developing new techniques and materials, and creating a vast new reservoir of supply.

The result of all this is a great new market of the future: A growing demand for millions of war-restricted articles—new, improved products for post-war competition—a backlog of savings created by war bonds and

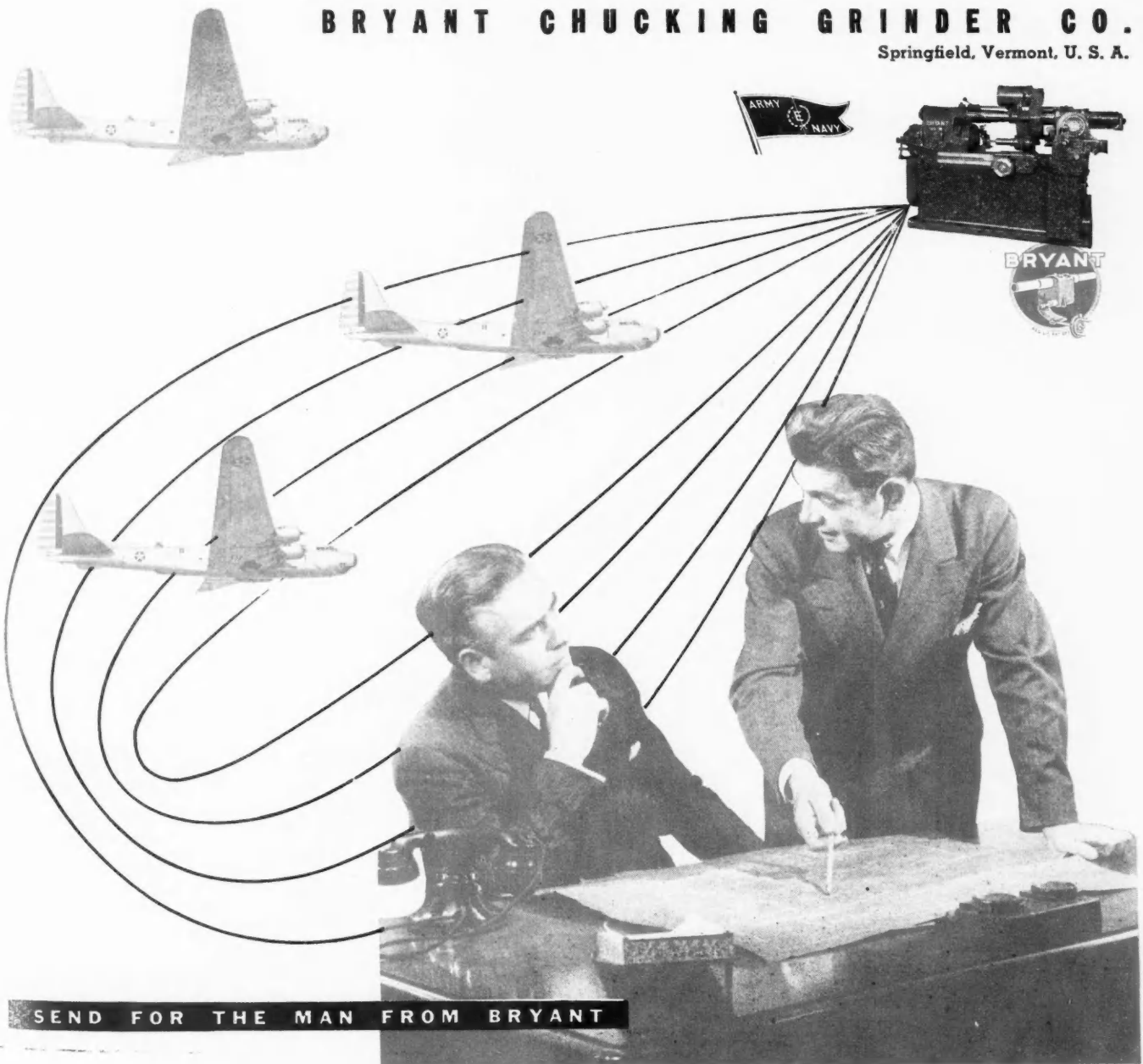
curtailed buying. . . . The result, say many of America's foremost analysts, is *post-war prosperity!*

If you are to be prepared for a quick transition from armament to peacetime business, now is the time to study your tooling problems—and in this we can help you. For Bryant engineers are among the foremost authorities in the specialized field of internal grinding . . . and today, with their major war production problems solved, they are once more ready to help you.

Write now and give them full information on your internal grinding problems.

BRYANT CHUCKING GRINDER CO.

Springfield, Vermont, U. S. A.



PUBLICATIONS

Catalog 2942, issued by Young Radiator Co. describes its **Vertivent Heater and Ventilator** which was designed and developed to meet needs for this type of equipment for installation in war production plants.*

The B. F. Goodrich Co. has just issued a new **De-Icer Handbook** which goes into the subject in technical detail, is well illustrated by drawings and engineering sketches and has sections devoted to installation, care and maintenance.*

Westinghouse Electric & Mfg. Co. has issued a new booklet **A Challenge to Design-**

ers of Drive Control which describes **Roto-trol**, a versatile d-c drive control.*

Many essential production degreasing and maintenance cleaning operations in aircraft and accessory manufacturing plants are reviewed in the second edition of a newly revised, enlarged manual just issued by Oakite Products, Inc. The booklet is titled **Oakite Cleaning Materials and Methods in the Aviation Industry**.*

The Square D Co. has issued a new catalog carrying detailed descriptive and engineering information of compact devices, including **circuit breakers, switches, relays, contactors, etc.***

The Diamond Chain and Mfg. Co. has just published its **Engineering Handbook No. 643**, giving complete information on the selection, installation and maintenance of

precision roller-type chains and sprockets for aircraft usage.*

Joseph T. Ryerson & Son, Inc., in celebrating its 100th birthday has commemorated the occasion by publishing a brochure **100 Years of Peace and War**. Attractive drawings illustrate the story of Ryerson—and the nation.*

Minnesota Mining and Mfg. Co. has issued a new booklet describing newly developed equipment incorporating the use of surface coated abrasive belts for producing faster and better finishes. The booklet is titled **3-M Method of Polishing and Finishing**.*

Eutetic Welding Alloys Co. has prepared a display poster for use in shops **How To Salvage Tools**, which gives a complete procedure for salvaging every type of tool vital to the war program.*

Two new and attractive booklets have been issued by Cleereman Machine Tool Co. Catalog No. 300 describes and illustrates its **Jig Bore**s and gives specifications for the new **Model C Jig Borer**. Catalog No. 400 describes, illustrates and gives specifications for its line of **drilling machines**.*

Worthington Pump & Machinery Co. has issued a new Bulletin No. S-550-B21 describing, illustrating and giving specifications for its **CCG gas engines**.*

A new handbook has been published by The Black & Decker Mfg. Co. which is designed to show new workers, especially in war industry plants, the correct methods of using **Portable Electric Drills**. The booklet covers assembling the drill, switch control, drill chucks and bits, how to use the drill and important points on user maintenance and care.*

Beat The Small Tool Shortage With Udylite Hard Chrome Equipment is the title of a new booklet recently issued by Udylite Corp.*

Foster No. 5 Universal Ram Type Turret Lathes are described and illustrated in a new catalog issued by International Machine Tool Corp. Subjects included in the booklet are lubrication, machine attachments, chucking tools and specifications.*

*Obtainable through Editorial Dept., Automotive and Aviation Industries, Chestnut and 56th Sts., Philadelphia. In requesting any of these publications, please give date of issue, your company connection, and position.

Plane Parts Excepted

Although Maximum Price Regulation No. 136, as amended, established maximum prices for repair parts or specially designed airplane servicing and repair tools, aircraft and aircraft engine manufacturers need not file their prices on such products with the OPA, it is announced by the OPA.

40 YEARS AGO

Under date of Jan. 10, S. M. Butler, secretary of the A. C. A., sent out the following circular letter: "It is the intention of the Automobile Club of America to hold some time in the spring a contest for commercial vehicles. The contest committee of the club are desirous of meeting with the manufacturers of trucks and delivery wagons and all types of commercial vehicle to receive suggestions to aid them in formulating rules for such a contest, and have appointed Thursday, Jan. 22, 1903, at 4 p. m., at the clubhouse, 753 Fifth Avenue, New York, as the time and place for such meeting. Kindly advise us if you are in sympathy with such a contest and if you will attend the meeting and give us your suggestions.

From *The Horseless Age*, Jan. 14, 1903.

FLASH!
It's disconnected

and air is automatically turned off by simply pulling back outside sleeve with thumb or finger.

FLASH!
it's connected

— a slight push of plug into socket, it's connected and air is automatically turned on.

Hansen **PUSH-TITE**
AIR HOSE COUPLINGS



With a Hansen air hose coupling there is nothing to twist, turn or lock . . . a slight push it's connected and air is automatically turned on, a push with thumb or finger it's disconnected and air is automatically turned off. Nothing to bind, stick or jam regardless of rough usage. They're faster, easier to operate, absolutely leakproof from one ounce pressure to well over 14,000 lbs. Full swivel action, no twisting or kinking of hose. Send for free catalog.

Hansen **MFG. CO.**

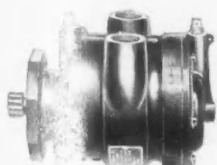
INDUSTRIAL Air Line EQUIPMENT

1786 EAST 27TH STREET

CLEVELAND, OHIO



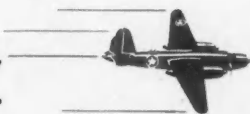
PERFORMANCE CONTROLS THE AIR



Pesco Air Pump for
vacuum and pressure

Greased Lightning, Made in U. S. A., strikes at the heart of the enemy. Everything depends upon split-second action, split-second performance. There cannot be a single failure. That's the responsibility of thousands here at home . . . to build each part for each plane with full realization that a life and a battle may depend upon it.

In Aircraft Hydraulics, Fuel Pumps,
Air Pumps, Related Accessories . . .



Pesco

PERFORMANCE POINTS TO FIRST

DIVISION BORG-WARNER, CLEVELAND, OHIO



Only Parts that can "TAKE IT"
ARE GOOD ENOUGH FOR THE JEEP!

C LIMBING stiff grades in Alaska, crashing streams and mud in Australia, conquering the endless sands of Africa, the Jeep has been called "the motorized mustang of the Army."

Tough? It has to be! And so do the parts of which it is made. That is why Permite Pistons, Valves and Water Pump Shafts are used in the "Go-Devil" engine of the Willys Jeep.

The tensile strength to resist severest strains, the light weight for speed and maneuverability, are achieved in many vital parts of motorized vehicles, aircraft and other war equipment by use of Permite Aluminum and Magnesium Alloy Castings and other Permite Products. The quality of every Permite Part is assured by our years of pioneering experience, our unexcelled laboratory and production facilities, and rigid inspection system.

Tremendously expanded production facilities permit us to supply a wide variety of the casting requirements of war production manufacturers. Requests for recommendations and quotations are given prompt attention.

ALUMINUM INDUSTRIES, Inc., Cincinnati, Ohio

Detroit: 902 New Center Bldg. Los Angeles: 324 N. San Pedro St. Chicago: 616 S. Michigan Ave.



PERMITE ALUMINUM AND MAGNESIUM ALLOY CASTINGS

Obituary

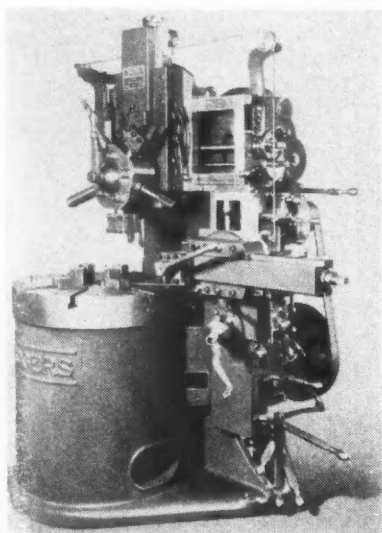
John D. Mansfield 70, board chairman of Chrysler Corp. of Canada, Ltd., died suddenly Dec. 26 at his home at Windsor, Ont. He had been in charge of Chrysler's Canadian operations since 1928. Prior to his association with Chrysler, he was an official of Durant Motors Co.

William Orwin Banta, 58, sales manager of the replacement service division of the Sealed Power Corporation, died suddenly on December 31, 1942, at his home in Muskegon Heights, Michigan. He was born near Rensselaer, Indiana, and attended school in Chicago, later graduating from Valparaiso university.

E. C. Fink, 62, president and chairman of the board of Mack Trucks, Inc., died in New York City on Jan. 1, following a heart attack suffered a few days earlier. Mr. Fink had been an officer of the company since its organization in 1911.

High-Speed Turret Mill

A HIGH speed model has been added to the line of vertical turret mills made by Rogers Machine Works, Alfred, N. Y. This machine is designed for boring, drilling and turning non-ferrous castings and forgings in aircraft and similar high-speed, high-production industries. It incorporates the



The Rogers High Speed Model Vertical Turret Mill.

same features as the standard Rogers vertical mill, but the main drive sheave of this high speed model runs at 760 r.p.m., which is double the 380 r.p.m. of the standard model. The swivel side head is adjustable to any angle each side of the vertical up to 35 degrees to facilitate tool setting for irregular shaped pieces.

MEN

(Continued from page 54)

ed the Lawrence Sperry Award for 1942 for "outstanding contributions to the art of airplane designs, with special reference to four-engined aircraft."

Dr. Thomas Midgley, Jr., vice-president of the Ethyl Corp., has been elected president of the American Chemical Society for 1943.

J. R. Barrett has been appointed manager of the newly established aviation division of Chevrolet's Flint plant.

Arthur M. Swigert, master mechanic of the Chrysler Corp., has been appointed a member of the sectional committee on classification and designation of surface qualities of the American Standards Association.

Brig.-Gen. Donald Armstrong, formerly chief of the Ordnance Dept. Tank-Automotive

Center, Detroit, has been appointed commanding officer of the Ordnance Replacement Training Center at Aberdeen, Md.

Lewis L. Lukes, formerly vice-president, has been elected president of General Exchange Insurance Corp. and Motors Insurance Corp., subsidiaries of General Motors Corp. Livingston L. Short, former president, resigned to become a member of a State Dept. mission now overseas for the Lend-Lease Administration.

Sam Shapiro, manager of the Chicago Automotive Trade Association, is on a year's leave of absence to serve as chief of the research section of the Automotive Branch of OPA.

The appointment of Irving R. Metcalf as technical director of the Aviation Division, Whiting Corp., Harvey, Ill., has been announced. Mr. Metcalf was formerly with Allison Division of General Motors.

DANLY KWIK-KLAMPS

**TOGGLE CLAMPS
FOR QUICK, POSITIVE
CLAMPING IN
ANY POSITION**

WITH

**STANDARD
HALF TURN**

**OR STRAIGHT
CLAMPING BAR**

WRITE YOUR DANLY BRANCH
DANLY MACHINE SPECIALTIES, INC.
2100 So. 52nd Ave. • Chicago, Ill.

Milwaukee, Wis. Dayton, Ohio Rochester, N. Y.
Long Island City, N. Y. Detroit, Mich. Cleveland, Ohio
Philadelphia, Penna.

Ducommun Metals & Supply Company, Los Angeles; San Francisco

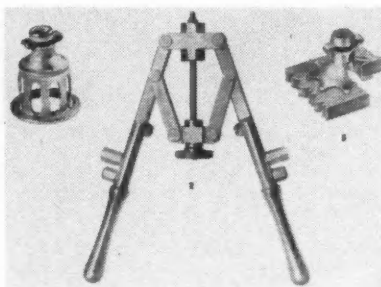
**DANLY DIE SETS and DIE
MAKERS' SUPPLIES**

New Products for Aircraft

(Continued from page 45)

THE Boots self-locking "Cage" Nut, made by the Boots Aircraft Nut Corporation, New Canaan, Conn., was designed to speed production of plywood aircraft. It incorporates the wing style, all metal, self locking principle and may be applied in a blind application, from one side, by a single operator.

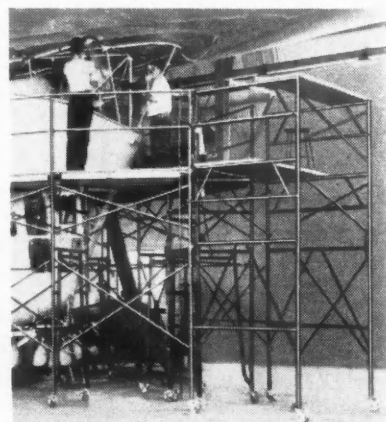
The basket mount of this nut is "collapsed" by means of a special clinching tool. The collapsed mount then clinches the plywood in a claw-like grip which



The Boots Self-Locking Cage Nut

withstands the torque applied when a bolt is inserted by production methods. The clinching tool is adjustable to varying thicknesses of plywood or plastic, from 1/16 in. up, by the use of stop arrangements.

SAFWAY steel scaffolding, made by Safway Steel Products Inc., Milwaukee, Wis., consists of two end frames which, when erected, are held rigidly together by two cross braces. This forms a complete unit 5 feet wide, 7 feet long and 5 feet high. Desired heights are obtained by adding similar



Safway Steel Scaffolding in use on Blimp Assembly Line.

for Self-Aligning BEARINGS

Ledaloyl
SELF LUBRICATING
Patented

Powdered Bronze



NEW Catalogue

Listing over 2000 stock sizes of Johnson LEDALOYL for which we have tool and die equipment. Write for your free copy.

When you design a new motive unit, give serious consideration to the use of self-aligning bearings. Properly designed and installed, they deliver excellent service plus the large saving they make in assembly operations.

When you want self-aligning bearings that are low in cost, yet tops in performance... specify JOHNSON LEDALOYL. This new development in powder metallurgy provides all the excellent bearing qualities of cast bronze but eliminates the expense of machining. In addition, LEDALOYL holds up to 35% oil by volume, thus assuring the right amount of lubrication in the right place, at the right time.

Why not investigate the possibilities of using LEDALOYL in your product? Complete information is available at no obligation. Write today.

JOHNSON
SLEEVE BEARING
625 S. MILL STREET



BRONZE
HEADQUARTERS
NEW CASTLE, PA.

Soybean Rubber

Reichold Chemicals, Inc., Detroit, has become the first commercial producer of synthetic rubber from soybeans in this country. Agripol, a chemurgic rubber, has been under experiment for more than a year and is now in production at a rate of 250,000 pounds per month. This is expected to step up to 2,000,000 pounds per month by February, 1943, and to 4,000,000 pounds per month by next May. Agripol is not offered as a substitute for rubber in the making of tires, according to Henry Reichold, chairman of the board. But it can be used in mechanical products such as gaskets, belting, insulating mats, hose linings and latex products as well as military uses such as insulating parts and shock absorption pads for aircraft, naval vessels and motorized weapons.

Principal raw materials used in the manufacture of Agripol come from the farm—soybean oil and ethyl alcohol. Fatty acids extracted from the soybean oil, when polymerized with ethylene glycol, produce Agripol.



AN ENTRY ON THE SERVICE RECORD

King-Seeley Corporation has always been an aggressive—yes, fighting—organization. Yesterday it was fighting for its share of business. Today, with a greatly-expanded capacity, it is still fighting—but fighting on the war production front. The Armed Services are receiving 98% of all goods produced.

FOR MILITARY VEHICLES

K-S all-electric instruments
K-S Speedometers
Handy Vari-Speed Governors

FOR AIRCRAFT

Especially-designed equipment

FOR ARMY AND NAVY

Handy Servo Mechanical Governors

FOR THE GUNS

A variety of ammunition components



★ ★ ★ **KING-SEELEY** ★ ★ ★
CORPORATION
ANN ARBOR  MICHIGAN

One-Piece, Hollow Steel Propeller Blades

(Continued from page 22)

tion by further polishing on the belt sanders. The blades now are fitted into huge cylindrical work-holding fixtures or shuttles in preparation for final grinding. In this area will be found large batteries of centerless cylindrical and internal grinders. Shank ends are rough- and finish-ground in separate settings on the cylindrical grinders; internal bore of the shank is ground on the internal grinders.

The blades are then hand polished and inspected, followed by sand belt

polishing. Then comes one of the final balancing operations—horizontal and vertical balancing. The blade is magnetically tested following this operation.

It may be noted at this point that each balancing station is in reality a separate inspection booth and that there are as many individual booths as there are balancing operations. At the end of this line of inspection stages we reach the final template checking to verify the accuracy of the preceding

polishing operations. Then the shank end is threaded in a thread milling machine.

Final production balancing makes the last checks on horizontal and vertical balance to compensate for the threading operation. And once more the blade is subjected to magnetic examination.

Each blade is given a special black finish as a protection against corrosion and which eliminates the objectionable glare of a polished blade.

Before shipment to destination, each blade is subjected to Army Air Force inspection, at which time the Army inspectors check all dimensions, contour, vertical and horizontal balance, and examine the X-ray plates for each blade.

When completed, the blades are not only balanced but are all of a uniform weight and have the same horizontal moments.

The foregoing marks the high-lights of one of the most scientifically developed production processes to be found in the airplane industry. Each element of process has a definite meaning and bears a definite relation to the end result. It is hoped that this brief description supplemented by a sampling of pictorial views will give the reader some appreciation of what is involved in the manufacture of a high grade propeller for our flying services.



**Finger-Tip or
Push-Button CONTROL
of MASSIVE
MACHINE MOVEMENTS**

with NOPAK Operating VALVES

The application of air or fluid power to heavy, cumbersome machine movements is giving old machines new life, new usefulness, greater capacity to meet war production quotas.

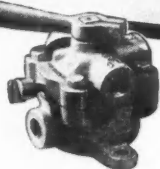
NOPAK Air or Hydraulic Cylinders controlled by NOPAK Operating VALVES are used to actuate clutches, chucks and clamping devices; to move or hold materials, dies or tools in position on highly diversified machine operations. Physical strain and exertion are replaced by push-button, foot-pedal or finger-tip control. The elements of human error and fatigue are minimized. Skilled labor is released for more exacting work, as inexperienced men or women are readily trained to operate your modernized equipment.

If you have machines in your plant that might be converted to push-button or fingertip operation, write today for complete data on NOPAK Control Valves, NOPAK Air and Hydraulic Cylinders.

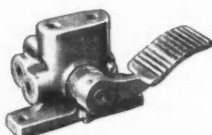
GALLAND-HENNING MFG. CO.
2774 S. 31st Street • MILWAUKEE, WIS.

NOPAK VALVES and CYLINDERS
DESIGNED for AIR or HYDRAULIC SERVICE

Representatives in Principal Cities



NOPAK 3- and 4-Way Hand Control Valves are known for their easy, finger-tip operation on air or hydraulic installations.



NOPAK Foot-Operated Control Valves require very little pressure to operate, are available in 2-, 3- and 4-way types for various operating cycles. Leave operator's hands free for other duties.



NOPAK Solenoid Valves, 3- and 4-way, facilitate push-button, automatic or remote control of single or double acting cylinders on many types of equipment.

Rolls-Royce Merlin "61"

(Continued from page 35)

effected with only a negligible decrease in pressure, it is stated.

The intercooler itself is not directly cooled by air draught, but by the coolant being circulated through an external radiator, which can be located at any convenient point on the engine or the aircraft and which on the Spitfire fighter is installed under one of the wings in a duct wherein also is the engine oil cooler. The engine coolant radiator is located in a similar duct below the other wing. The intercooler coolant is also circulated through water passages in the supercharger casing between the two rotors, serving to control the temperature of these and their casing. A special pump is provided for this cooling system, for the latter is entirely separate from the cooling system of the engine itself.

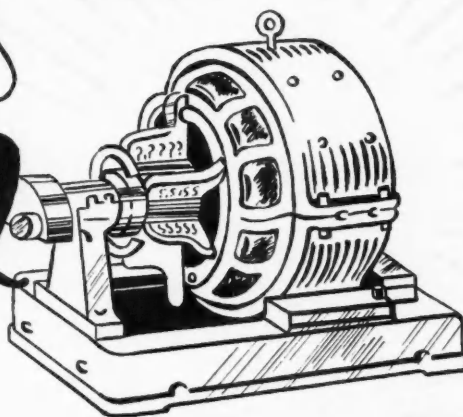
Despite the larger size of the supercharger, it adds only 5 in. to the overall length of the engine relative to the Merlin XX. As regards weight, the "61" is said to weigh approximately 1600 lb "dry," compared with the 1450 lb of the earlier model.

Another difference in design is the adoption of detachable cylinder heads for the "61." The two-piece cylinder blocks are similar to those designed by Rolls-Royce for the Merlin XX produced by the Packard Co. Circulation of the coolant between cylinder jackets and head jackets is through exterior connecting ports with rubber seatings.



junk!

NOT THIS YEAR



**WRECKED MOTOR
WAS BACK ON THE
JOB IN 24 DAYS**

LARGE MOTOR LITERALLY WRECKED BY OVERSPEEDING. IN NORMAL TIMES IT WOULD HAVE BEEN JUNKED AS SCRAP METAL. BUT IN THIS WARTIME YEAR DELAY IN GETTING NEW ONE WOULD HAVE MEANT SLOWDOWN IN STEEL MILL PRODUCTION. WRECKED MOTOR RUSHED TO NEAREST WESTINGHOUSE MANUFACTURING & REPAIR PLANT...COMPLETELY REBUILT...TESTED...WAS BACK ON THE JOB IN 24 DAYS! BACK ON THE JOB...SUPPLYING UNCLE SAM WITH FIGHTING METAL.



Westinghouse
MANUFACTURING AND REPAIR
J-90455



**IF THE EQUIPMENT NEEDING REPAIR IS
VITAL TO THE WAR EFFORT... PHONE
THE NEAREST OFFICE OF WESTINGHOUSE
ELECTRIC & MANUFACTURING COMPANY FOR**



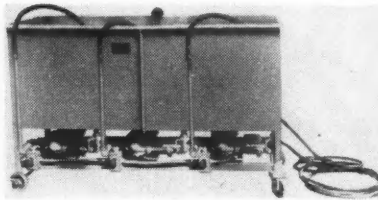
EMERGENCY SERVICE

33 M & R PLANTS . . . ONE NEAR YOU!

New Production Equipment

(Continued From Page 33)

model OCC-1, has three compartments, each of which has a capacity of 10 gallons. The first is for flushing the oil temperature regulator and cleaning its outside surface, in the second compartment, containing clean solvent at about 100 deg. F., it is again flushed, and in the third one motor oil is pumped through the regulator to prepare it for storage and future use. Three packless type pumps are used, each driven by a 1/4 hp. motor. Total time required is ap-



Machine for Cleaning Oil Temperature Regulators, made by Circo Products Company.

proximately 15 minutes for each regulator, but all compartments can be operated simultaneously. When so operated, an oil temperature regulator can be processed in about 5 minutes.

RACKS for drying cores in foundries have been added to the line of shop trucks, portable bins, shop boxes and trays made by the Factory Service Company, Milwaukee, Wis. The racks are standardized units and are suitable for use with the two wheeled transport. The outfit can be moved with the hand

NEW

IDEAL

METAL ETCHER

★ PREVENTS DELAYS

caused by

LOSS, THEFT, MISTAKES

14

Heats

★ PERMANENTLY MARKS

TOOLS, DIES, GAUGES,
PARTS, ETC.



New, All-Purpose Etcher for permanently marking smooth-surfaced iron, steel and their alloys. 14 heats. Etches legibly, easily, permanently regardless of the hardness of the metal. Convenient ground clamp for etching large, heavy parts and castings.

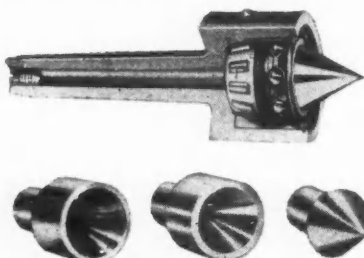
ELECTRIC
MARKERS

MOST COMPLETE LINE ON THE MARKET

ELECTRIC
ETCHERS

IDEAL LIVE CENTERS

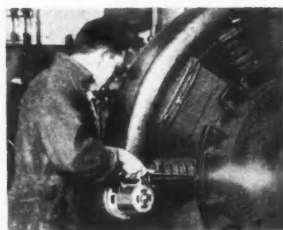
IDEAL "3-IN-1" JUMBO
ELECTRIC CLEANERS



Produce more work quicker, on lathes, millers, grinders, etc. Save set-up time. Fitted with high precision radial ball bearings and tapered roller bearing. 3 interchangeable inserts for all centered and uncentered work.

FREE— MACHINE TOOL
ACCESSORIES
CATALOG

Gives full details on IDEAL Live Centers, Demagnetizers, Marking Tools, Balancing Ways, and other Machine Tool Accessories that speed production and keep costs down.



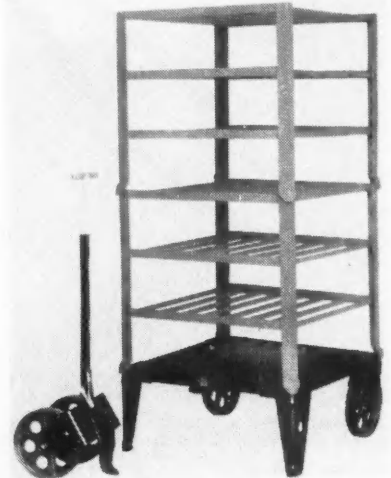
Get rid of dirt, dust, metal chips, that slow up production—cause shutdowns! Keep machines and motors *clean*—with the IDEAL "3-in-1" Jumbo Electric Cleaner. Super-Powered. 1 H.P. Motor. Air velocity, 24,200 ft. per minute! Removes dirt from hard-to-get-at places. Portable. Inexpensive. Complete attachments available.

IDEAL COMMUTATOR DRESSER CO.

3000 Park Avenue

Sycamore, Illinois

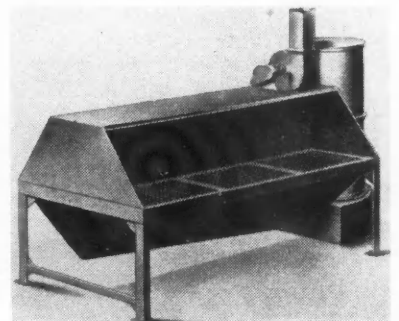
SALES OFFICES IN ALL PRINCIPAL CITIES
In Canada: Irving Smith, Ltd., Montreal, Quebec



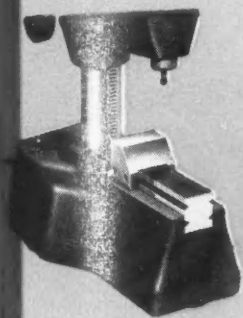
Core Drying Racks, Transport and Hand Jimmy made by Factory Service Company.

Jimmy or by power lift truck, crane, tractor or conveyor. The core drying racks interchange with the bins, boxes and trays made by the Factory Service Company, and when not in use, may be removed and the transport used for other purposes.

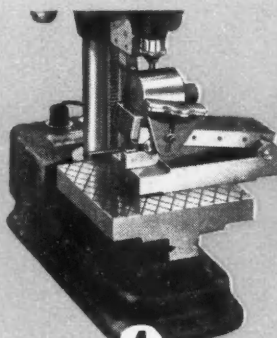
FOR operations on magnesium castings such as hand grinding, chipping and burring, the Claude B. Schneible Co., Chicago, Ill., has developed several types of downdraft ventilating benches. These benches have hard wood gratings of proper area and spacing to suit the work. Canopies and end sheets guard against side drafts and provide maximum ventilating efficiency with a minimum volume of air. Downdraft grinding benches are made



Ventilating Bench made by Claude B. Schneible Co.



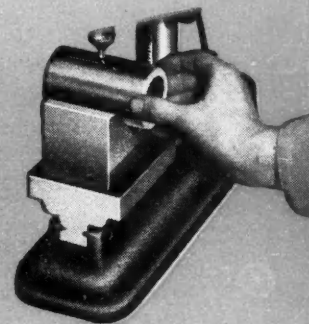
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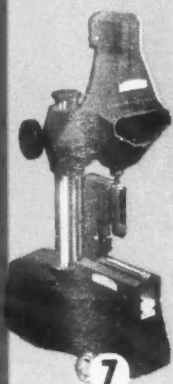
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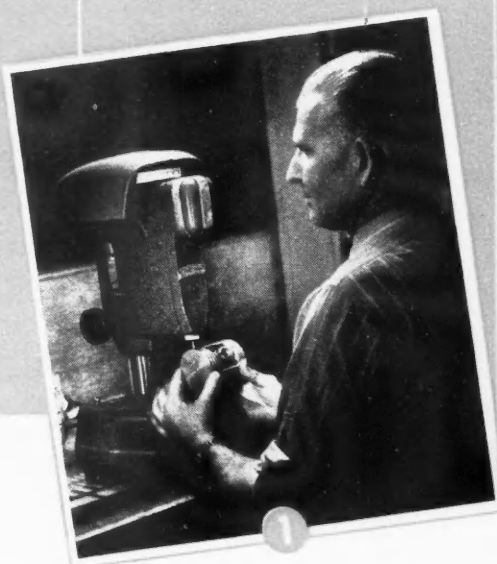
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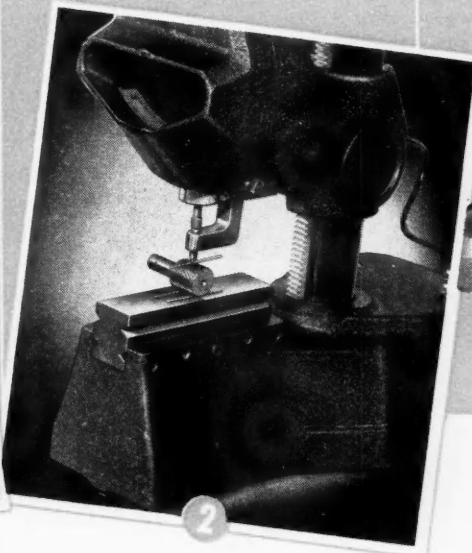
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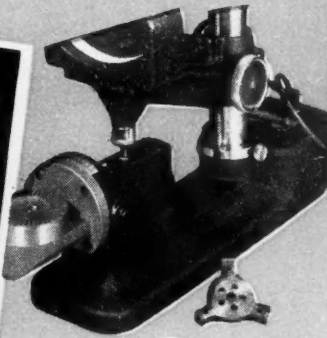
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1



2



8

ARE YOU GETTING *Maximum Service* FROM YOUR VISUAL GAGES?

1 Equipped with plain and serrated anvil for the checking of width, thickness, height, or outside diameter.

2 Equipped with flat anvil and thread wire attachment for checking pitch diameter of screw threads.

3 Equipped with standard backstop for accurate and rapid positioning of work being gaged.

4 Equipped with wide anvil and Sheffield sine bar fixture for the checking of tapers.

5 Equipped with Sheffield Internalgage for the checking of inside diameter, taper, and out-of-round.

6 Equipped with wide anvil and V-block for checking outside diameter of cylinders and bushings.

7 Equipped with fixture to check ball diameter of an inner ball race.

8 Internalgage with fixture to check a depth.

The Sheffield Visual Gage is used for many purposes. If you are not familiar with all of them, the outline here may suggest a means of increasing the effectiveness of your gages and the variety of work they do. Sheffield Visual Gages are used:

In the Inspection Department
For the final inspection of close tolerance manufactured parts.
For the classification of such parts as the basis for selective assembly.

In the Tool Room
To check fixed size gages for wear.
To check precision gage blocks for wear.
To check the dimensional accuracy of tools.

In the Production Shop
To provide machine operators with an accurate check on work in process.

In the Receiving Department
To check dimensional accuracy of purchased parts and sub-assemblies on arrival.

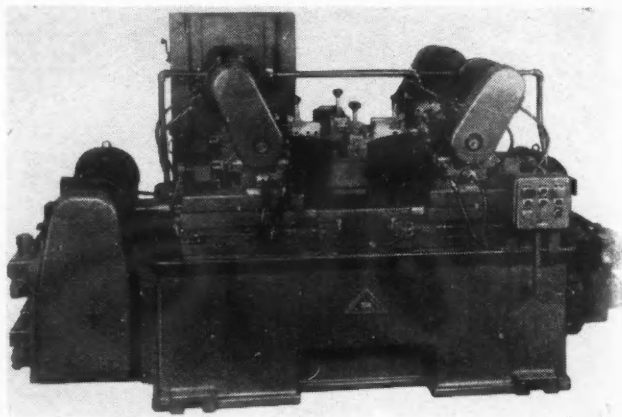
In the Laboratory
To provide maximum accuracy for measurements of all kinds.

THE **SHEFFIELD** CORPORATION
SHEFFIELD GAGES

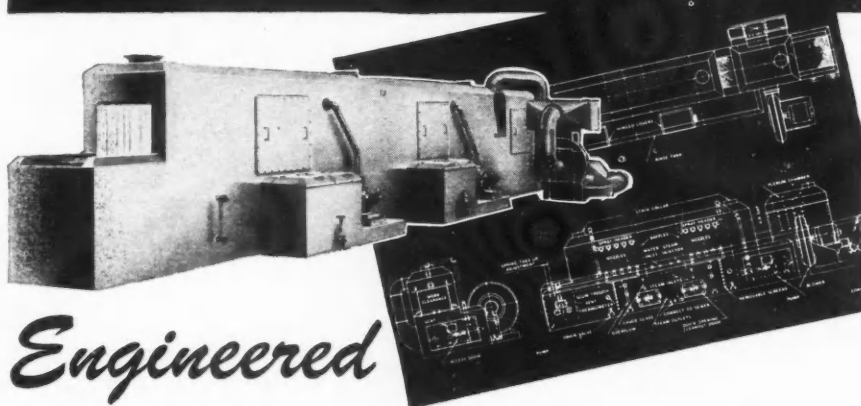
with a "V" shaped hopper at the bottom which also forms the exhaust duct. The bottom of this hopper slopes toward the exhaust outlet, and is flushed with oil, when necessary, to pick up the heavier particles and carry them to the settling tank. The air-borne particles are collected in a Multi-Wash unit which uses the same recirculated oil as the collection medium.

A SPECIAL hollow mill is announced by LeMaire Tool & Mfg. Co., Dearborn, Mich. It was designed for machining a round trunnion on each end of a turbine blade, and at the same time facing the blade to length.

A Special Hollow Mill Built by LeMaire Tool & Mfg. Co.



DETREX METAL PARTS WASHERS

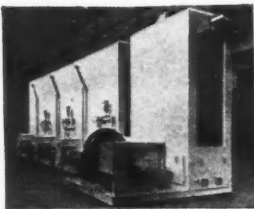


Engineered
TO MEET Your METAL CLEANING NEEDS

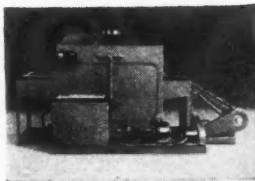
Detrex Washers—using alkali cleaning compounds, petroleum spirits or emulsion cleaners—are engineered to the customer's need. Incorporated is every detail which can contribute to long life and high efficiency.

Among the features of Detrex Washers are heavy, reinforced construction; balanced heat input; fully effective drying equipment, and proper directional spraying. Large access doors permit easy inspection, cleaning and adjustment of spray nozzles. Each washer with self-contained conveyor is equipped with variable speed drive. Conveyors used include monorail, slat belt and roller types.

Various models of Detrex Washers are pictured and described in the new catalog—"Detrex Metal Parts Washers". Write for your copy.



Four stage alkali spray washer with monorail conveyor. Used in cleaning of gun barrels, mounts and miscellaneous parts.

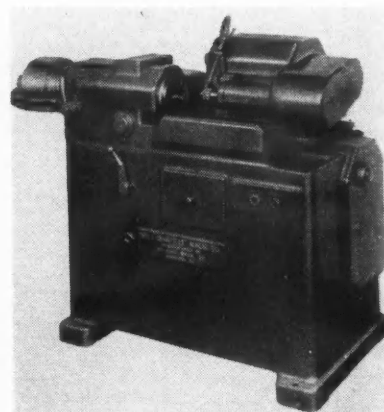


Single stage, through type, spray washer built with mesh belt, slat type or double strand conveyor.

An index table carrying four special toggle clamp fixtures occupies the center of the machine, with hollow mills on two sides operating on horizontal slides. Each slide carries two auxiliary slides on which the cutter heads are mounted. The base of the machine houses the coolant fluid and the index mechanism. Power for moving the slides is furnished by hydraulic units mounted on each end of the machine.

The auxiliary slides, carrying the cutter heads, are pivoted and equipped with protractor and vernier scales, permitting the heads to be fixed so trunnions can be hollow milled at any angle. This feature makes the machine flexible enough to produce blades with trunnions straight with the axis on both ends, with one trunnion straight and the other at an angle, with a trunnion at one end only, or with both trunnions at an angle with the axis. It is possible also to make the blades with a concave shape around the trunnion, by using convex shaped cutters.

THE Hill-Bartelt Machine Company, Rockford, Ill., is presenting two models of a newly designed thread milling machine. One is a single-purpose machine set up for production on a specific job, the other is a general-purpose machine with adjustments which permit change of set-up for a wide variety of work. The same main elements are used on both of the machines. All driving elements, electrical controls,



The Hill-Bartelt Single-purpose Thread Milling Machine.



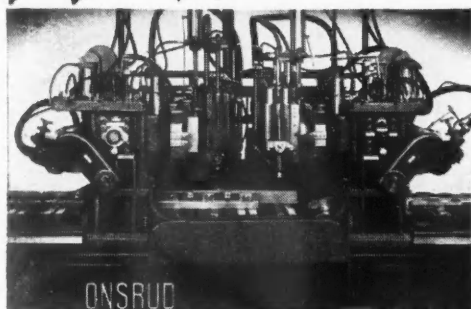
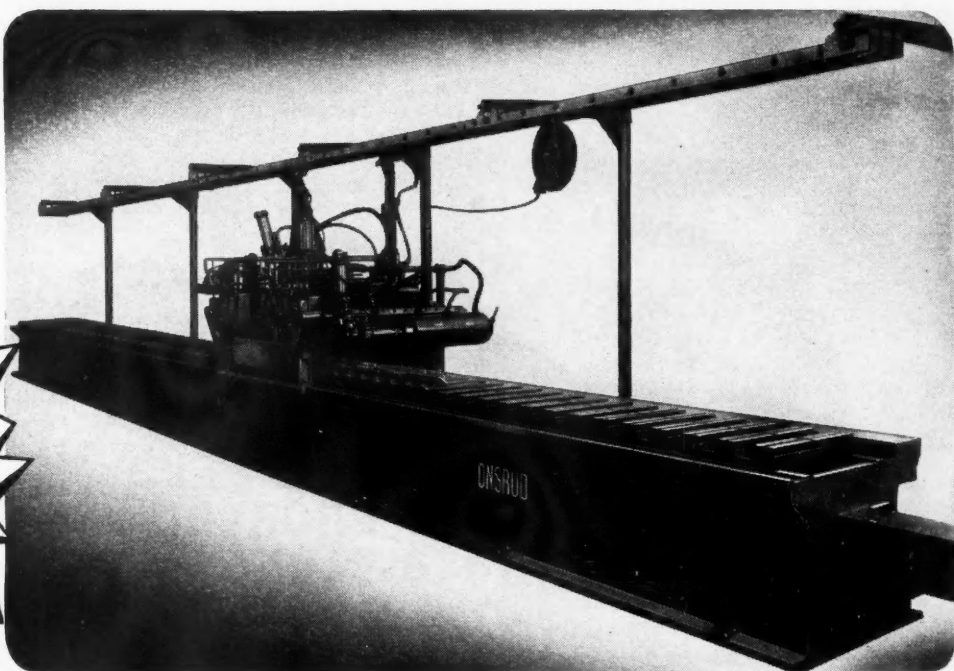
SOLVENT DEGREASING and ALKALI CLEANING

DETROIT REX PRODUCTS COMPANY

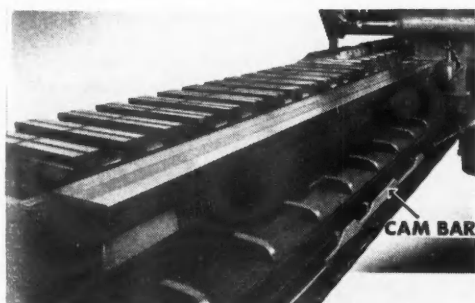
13001 HILLVIEW AVENUE • DETROIT, MICHIGAN

Branch Offices in Principal Cities of U. S. A. — In Canada: Canadian Hanson & Van Winkle Co., Ltd., Toronto, Ontario


**The Machine
that *Blasts*
Bottlenecks!**



Complete carriage assembly showing cutter motors and front operating stations. G.E. Thy-mo-trol unit converts A.C. line to D.C. permitting use of D.C. carriage feed motor and stepless rheostat speed control.



A view of the Cam Bar for Automatic Feed Control to slow down or speed up carriage travel according to the cutting demands made by the work. Proper feed rate is automatically maintained.

The new Onsrud A80-A Automatic Contour Miller increases still more the type of high speed production machining originated by the Onsrud Spar Miller. This new machine brings to a high degree of perfection the new milling technique which is effecting such important savings in aircraft manufacturing man-power, time and machines.

Taking cuts in both vertical and horizontal planes in one operation, the A80-A greatly simplifies and speeds up production of long, intricate shapes from billets or extrusions. Features like the following are responsible for the machine's high production rate and capacity for unusual types of work.

Four Cutter Heads

Two vertical and two horizontal. Up to four cuts in one operation. One of the vertical heads tilts under automatic pneumatic control to make varying angle or twist cuts.

Variable Speed Carriage

The carriage rides on a precision machined bed to feed cutters to the work at any speed from 2" to 18½' per minute.

Sectional Bed Construction

Bed is made up of combinations of 7½ and 15 ft. sections to any length desired.

Open Grate Table

Built in 20 in. sections. "T" slots on 9 in. centers permit air or hydraulic clamps to be placed below table surface. Speedy loading and unloading results.

Extra Carriage Support

A removable front carriage support makes possible greater rigidity when work requires.

High Cutter RPM

Cutters are driven by individual motors with ample power to maintain cutting speeds for all types of cuts.

For a complete and detailed description of the A80-A send for bulletin. Draw on our long experience in the field of high speed cutting and machine tool design to help you solve your machining problems. Write today to the

Onsrud

ONSRUD MACHINE WORKS, INC.

3915 Palmer Street, Chicago, Illinois, U.S.A.
Sales Offices in all Principal Cities

MACHINE TOOLS AND METHODS FOR TOMORROW'S PRODUCTION

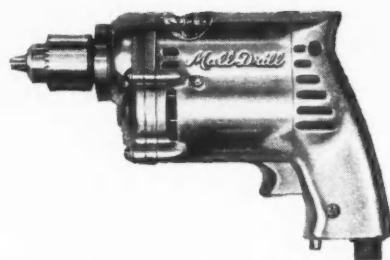
and the coolant system are enclosed, with suitable access doors and plates.

The single-purpose model can be made up for cutting either right or left hand internal or external threads, using a multiple type thread mill. A cam, synchronized with the work spindle, controls the feed and governs the complete cycle, including rapid return and a dwell for reloading. Work up to capacity of 3 in. diameter, is held in an air operated collet chuck.

The general-purpose model has a wider range of application. Either single or multiple type cutters may be used, and the cutter head has a tilting adjustment for aligning the cutter with

the helix angle of the thread. Two types of feed are available, either cam feed or lead screw. The machine will cut threads from 5 pitch to 32 pitch, up to 9 inches in length with a single cutter and up to 2 inches in length with a multiple cutter. A controllable cross feed permits cutting of pipe threads or partially tapered threads.

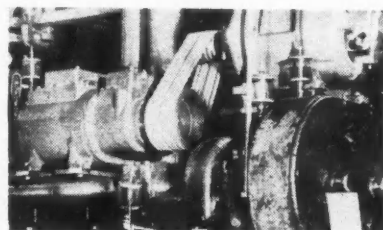
THE Model 143T one-quarter inch electric drill made by the Mall Tool Company, Chicago, Ill., features easy inspection and servicing. The commutator may be inspected, and brushes, switch or cord replaced without dismantling the drill. Over-all dimensions



The Model 143T Electric Drill made by the Mall Tool Co.

are: length, 8 1/8 in.; height, 5 1/8 in., and width, 2 3/4 in. The net weight, with cord, is 3 7/8 lbs. The MALLDRILL will be supplied for 110 volts or for 220 volts. The motors are universal type, and will operate on DC or AC, 25 to 60 cycle.

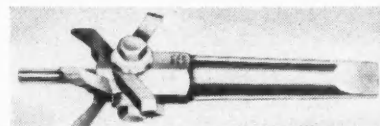
THE Western Super Transmission, being built by the Western Mfg. Co., Detroit, Mich., provides eight changes of speed, arranged in geometric progression. Overall ratio is 6 to 1, and the various speeds are obtained through



The Western Super Transmission

two automotive type shift levers. Speeds may be changed without stopping the machine. The transmission is suitable for use in connection with large lathes, boring mills, slotters or milling machines.

THE new Clark 3 Blade Adjustable Hole Cutters, made by Robert H. Clark Co., Los Angeles, Cal., are designed for use in electric drills, pneumatic motors, drill presses, lathes and milling machines. They are available in six models and will cut holes of 3/4 in. diameter to 4 1/2 in. diameter in metals, plastics, hard fibre or press-board. A lead drill can be used in place of the removable pilot.



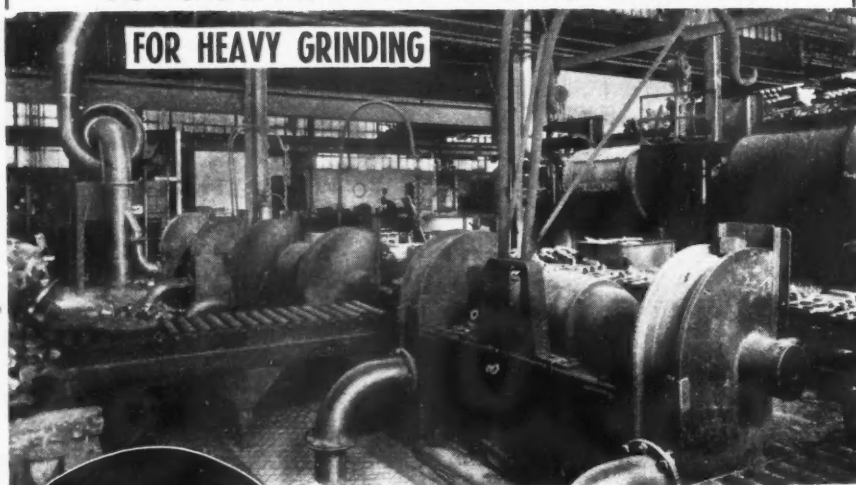
The Clark 3 Blade Adjustable Hole Cutter.

Wells Receives Award

The selection of Edward C. Wells of the Boeing Aircraft Co., Seattle, to receive The Lawrence Sperry Award for 1942 was announced in New York by the Institute of the Aeronautical Sciences. The Award is given annually for notable accomplishments by young men in the advancement of aeronautics.

EVERY GRINDING DUST PROBLEM IS SOLVED BY ROTO-CLONE

FOR HEAVY GRINDING



ROTO-CLONE combined exhaustor and dust separator offers exclusive advantages in the collection of all process dusts which are universally recognized. There is a size for every requirement—from single grinding wheel to any number or combination of dust sources. Complete engineering data is given in a group of bulletins describing in detail ROTO-CLONE'S operation and applications. Send for them without obligation.



FOR FINISH GRINDING



AMERICAN AIR FILTER COMPANY, INC., 449 CENTRAL AVE., LOUISVILLE, KY.
IN CANADA: DARLING BROTHERS, LIMITED, MONTREAL, P. Q.

Engineering Service for AMERICA'S War Industries

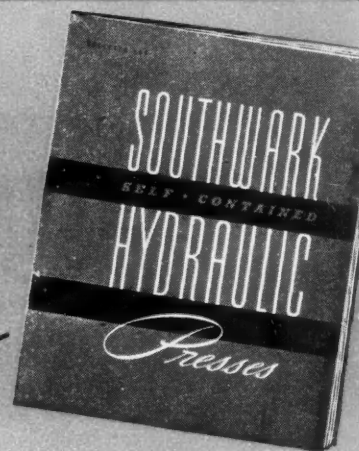
Southwark is serving America's war industries through the manufacture of specially engineered equipment and highly developed heavy-duty standard machines designed for a host of diversified applications. With one hundred and six years of experience in the manufacture of industrial machinery, with unsurpassed shop facilities, Southwark is meeting wartime requirements for all types of hydraulic presses, physical testing machines and instruments, rolls, planers, and special machinery—large and small.

Baldwin Southwark Division, The Baldwin Locomotive Works, Philadelphia; Pacific Coast Representative, The Pelton Water Wheel Co., San Francisco, California.

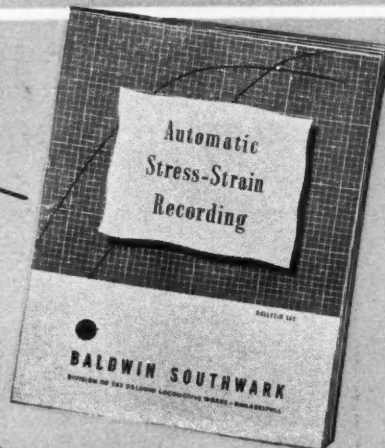


BALDWIN
SOUTHWARK

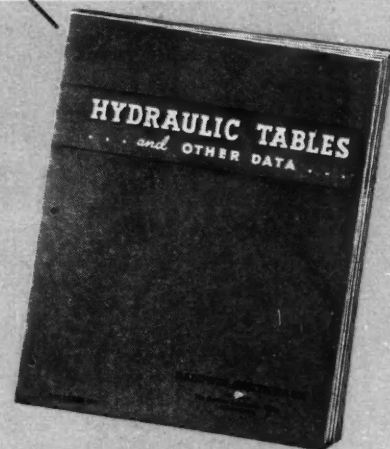
Division THE BALDWIN LOCOMOTIVE WORKS, Philadelphia, Pa.



Bulletin A-160. A catalog containing illustrations and technical information about Southwark Hydraulic Presses for a wide variety of applications.



Bulletin A-162. A discussion of wartime material specifications, the interpretation of stress-strain records, and the use and care of the equipment.



Bulletin A-150. A compilation of hydraulic tables and other useful information pertaining to those structures involving the use of hydraulic pressures for load producing purposes.

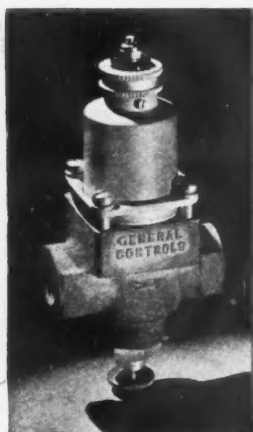


Bulletin A-161. Complete engineering and operating information on Southwark-Tate-Emery Testing Machines, including a description of accessories.

GENERAL CONTROLS

* hi-g

ELECTRIC VALVES FOR TANKS, TRUCKS AND OTHER MOVING EQUIPMENT



General Controls Type PV-1

GASOLINE SAFETY SHUT-OFF VALVE

Specifically designed for *positive operation*, regardless of conditions of vibration, change of motion, or acceleration on *all types of moving equipment*. One of a series of a complete line of electromagnetic valves handling all fluids, vapors and gases at pressures up to 3000 lbs. or more. For D.C. systems. Available normally open, normally closed for intermittent or continuous duty. **WRITE FOR BULLETIN.**

NO CONCESSIONS TO WEIGHT FOR AIRCRAFT OPERATIONS

THIS IS AN **8½ oz.**

valve designed for cabin heating, oil dilution, and anti-icing applications. Operates in any position, regardless of vibration, change of motion or acceleration. Although "g" factors as high as 300g are obtained, valve weight is only a fraction of a pound. Available for handling all fluids, gases, vapors and vapor mixes. **WRITE FOR BULLETIN.**



General Controls Type AV-1

*TRADE MARK—hi-g indicates positive ability to operate in any position, regardless of vibration, change of motion or acceleration.

GENERAL CONTROLS

PIONEERS AND LEADERS IN THE DEVELOPMENT
AND MANUFACTURE OF MAGNETIC VALVES
801 ALLEN AVENUE, GLENDALE, CALIFORNIA
BOSTON • NEW YORK • PHILADELPHIA • DETROIT
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Inventory of Machine Tools

(Continued from page 17)

ard had an inventory of 4000 machine tools for automobile building. One hundred and fifty of these have been transferred to other companies for war jobs. Of the 5300 new machine tools ordered by Packard, 4400 have been installed.

When the new Naval Ordnance Arsenal at Center Line, Mich., was completed, Hudson Motor Car Co., had to install more than 2400 new machine tools to carry on the work of keeping the Navy's guns and ordnance equipment in repair, as well as building Oerlikon anti-aircraft guns for Navy ships. On another Navy contract for marine engines, Hudson converted 700 automotive machine tools and utilized automotive production lines in its own plants to provide these power plants for naval vessels.

The Machine Tool and Equipment Service of the Automotive Council for War Production has listed some 250,000 machine tools of automotive companies in its files since it began to function just about a year ago. According to the Council, approximately 78 per cent of the automotive industry's machine tools have been converted to war assignments, while another 7 per cent is turning out vitally needed replacement parts to keep the nation's motor vehicles in operation. Only 15 per cent of the industry's machines have been found unsuited for war production.

More than 12,000 pieces of production equipment have been taken from automotive plants and sold or leased to war plants both inside and outside the automobile industry. Most of this interchange of machines has been accomplished through the Machine Tool and Equipment Service of the ACWP or the War Production Board. A Massachusetts factory found the required presses for stamping a bomb sight in the Detroit area. A spark plug company needing screw machines located several in an eastern automotive plant. A Wisconsin manufacturer of pressure cookers found the necessary equipment for making bomb fuses through the ACWP. Twenty-five coining presses urgently needed for the production of 40-mm shell blanks were uncovered in Detroit through this information service. These are only a few examples of the exchange of production equipment that has been accomplished in the automotive industry.

The degree of conversion of automotive facilities varies with the type of product to be manufactured. Chrysler was able to utilize 729 automotive machines when it took on the job of turning out 40-mm Bofors anti-aircraft guns. A similar degree of conversion has been experienced in certain armored vehicles and some ammunition components. But in the case of aircraft, the number of automotive tools adaptable to the manufacture of airplanes has been small. In General Motors' new Eastern Aircraft Division, only 250 out of 1000 automotive machine tools at the Linden (N. J.) Fisher body plant were salvaged. At the Bloomfield, N. J., plant, only 30 machines could be converted for aircraft manufacture.

Major orders remaining on the books of the nation's machine tool manufacturers are for aircraft production, which is now receiving prime emphasis in the war program in order to meet the 1943 goal of 100,000 war planes. Plants in the automotive industry whose tooling needs for aircraft work still comprise a big assignment include the Dodge-Chicago engine plant, the GM bomber plant and the Continental Aviation & Engineering Co. factory. The 300 machine tool manufacturers in the U. S. produced more than \$1,400,000,000 worth of equipment in 1942, almost double the 1941 output of \$711,000,000. Peak month of \$130,000,000 in shipments was reached in October. It has declined since then. The industry has about \$1 billion of orders remaining on the books, which will take nearly eight months to fill. The aircraft industry will have first claim on \$800,000,000 of these orders. If the 1943 aircraft program is to be fulfilled, the machine tool builders must deliver in six months machines which ordinarily would require three-quarters of a year. That is the challenge facing the machine tool companies, which so far have done an outstanding job in the war effort.



THE
*Accepted
Solution*

TO ENGINEERING PROBLEMS
INVOLVING FLUID SEALING
AND EXTRANEOUS
MATTER EXCLUSION

CHICAGO RAWHIDE MANUFACTURING COMPANY

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64 Years Manufacturing Quality Mechanical Leather Goods Exclusively and now Sirvans Synthetic Products

PHILADELPHIA • CLEVELAND • NEW YORK • DETROIT • BOSTON
PITTSBURGH • CINCINNATI

Adel Training System

(Continued from page 31)

Foremen are impressed also with the need for regular inspection of gages. These wear through constant use, and unless they are checked at regular intervals, scrapping of work and materials will result.

To better understand the machines under their supervision, shop leaders are given a detailed review of design and function. Whenever possible, a specialist is called in to give these lectures. For instance, Harding Bakewell takes off time from his own plant for

lectures on the Bakewell tapping machine. A question-and-answer period following the lecture gives foremen and supervisors an opportunity to discuss problems met with in the use and care of this particular machine.

To increase company spirit and co-operation, one lecture is given on plant administration, covering the plant-protection set-up, fire prevention, safety, and insurance.

An important part of the foreman-supervisor retraining course is the

morale-building lectures. Ten employee-relations rules are outlined and discussed:

1) Men would rather work under a leader than a driver. Under a driver they work because they *must*. Under a leader, because they *want to*.

2) When you criticize a man, don't hurt his feelings or destroy his self-confidence. Be patient. Furthermore you should remember that some men are slower than others in grasping a subject. That same man often develops into the best worker.

3) Don't make fun of one worker to another. Avoid sarcastic remarks.

4) Knowing how and what to do will make a man happy at his work. Nothing will make him more discontented than to feel he is uncertain in what he is doing. Every man likes to know the "Why" and the "How" of what he is doing.

5) Whenever you criticize a man for his work, make a point of going back to him later with a friendly word.

6) Don't act important.

7) Every man likes to be treated as a human being. Whenever possible, greet him by his first name.

8) Remember that you must give co-operation if you expect it in return.

9) Do everything possible to keep the relations of your department with other departments in good standing.

10) If you have a recommendation to make, write it down, as people more often remember what they see written.

Some foremen teach new-employee training classes, and all have new workers in their departments needing instruction, so a lecture on "How To Instruct" is included in the course. The following advice is offered:

1) Prepare the worker; put him at ease, find out what he already knows about the job, get him interested in learning the job and place him in the correct position.

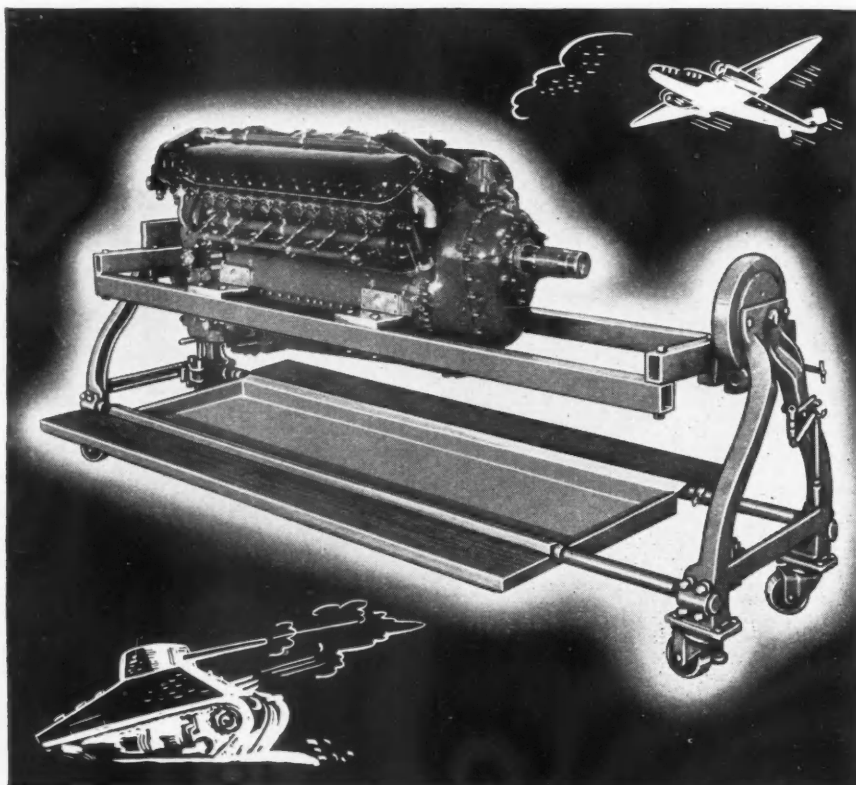
2) Present the operation; tell, show, illustrate, stress the key points, instruct clearly and completely.

3) Try out performance; test by having him perform a job, have him tell and show you, explaining key points, ask questions and correct errors, continue until you know he knows.

4) Follow up; put him on his own, check frequently and tell him to whom to go for help, encourage questions, taper off gradually with coaching, but keep a close follow-up.

Production Illustration, defined as the art of illustrating production by means of simple drawings of each operation in making and assembling airplanes, etc., to enable the untrained worker to understand and improve his production, is used not only in the shop but in training classes.

Instructors of trainees are advised to explain each machine with a complete break-down, defining principal parts, functions, adaptability of various parts and operation. They are told that in order to discuss any topic, the terms involved must be defined and the equip-



Designed to Speed Up Production, Rebuild and Tear-Down Engines

★ Designed especially for use in the building, tearing down and rebuilding of Allison engines, this engine stand is gear-driven, with provisions for locking at predetermined angles. All special tools required for this engine clear the mounting fixtures. Equipped with floor stops for holding stand rigid when not on assembly line. Literature on this stand, and on our complete line of stands for all types and makes of aeroplane engines will be sent on request.

Staley MANUFACTURING CORPORATION
COLUMBUS, INDIANA, U. S. A.

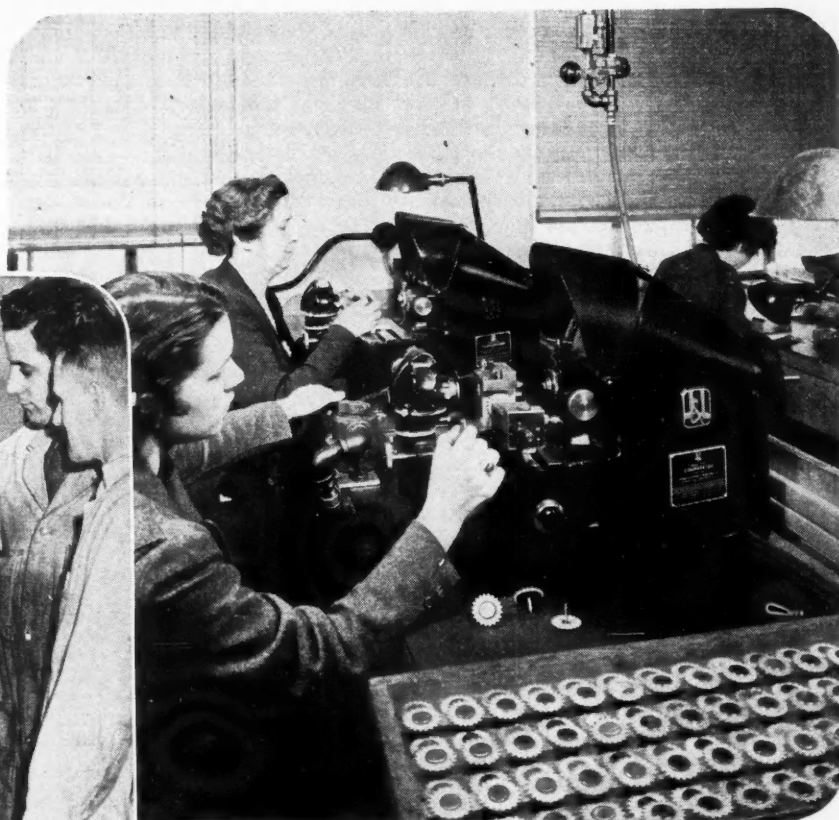
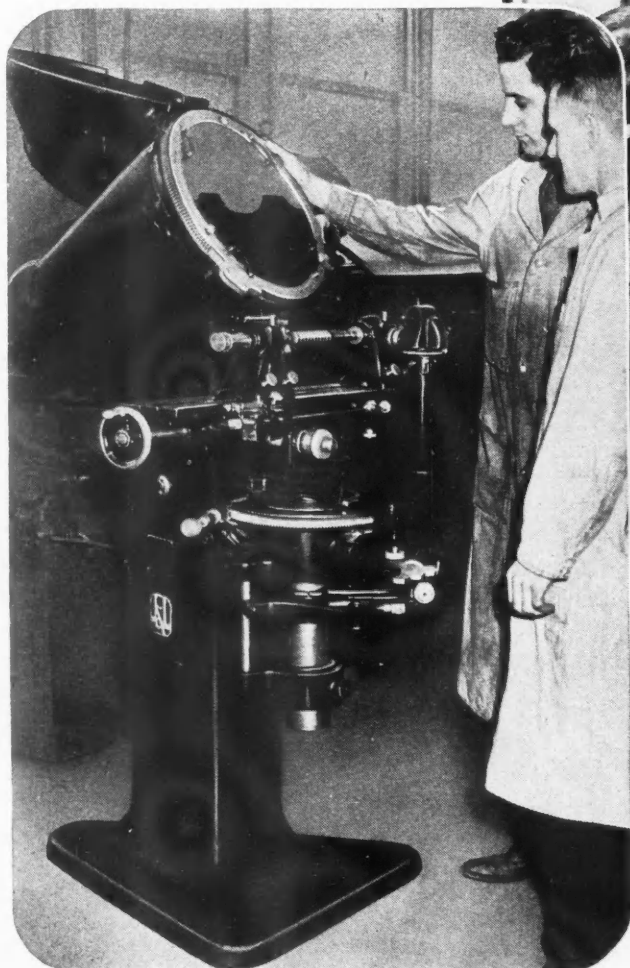
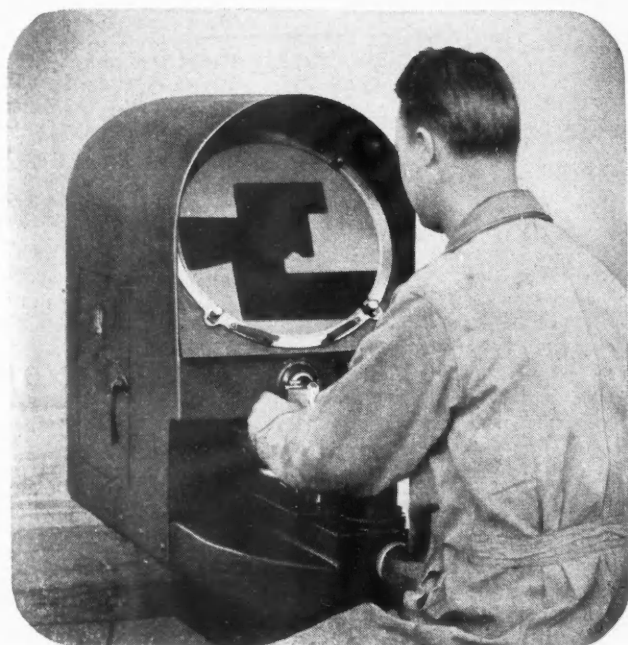


Photo Courtesy International Business Machines

Modern inspection by optical projection saves time and money

Jones & Lamson Comparators are available in Pedestal, Bench and other types to meet every need in the field of inspection by Optical Projection. We shall be pleased to study your problems and apply to them the accumulated experience of more than twenty years in this field.



Profit-Producing



Machine Tools

JONES & LAMSON MACHINE COMPANY

SPRINGFIELD, VERMONT, U. S. A.

Manufacturers of: Ram and Saddle Type Universal Turret Lathes · Fay Automatic Lathes · Automatic Thread Grinders · Optical Comparators · Automatic Opening Threading Dies and Chasers.

ment or instruments used must be identified.

From the first of July to the end of November there were 9,372 student hours in class attendance at Adel; classes in Inspection, Hydraulics, Burr Bench, Machine Shop, Valve Assembly, Blue-Print Reading and the special instruction for supervisors and leadmen. The value of this training has exceeded expectations.

Each new employee is given a hand book containing the layman's version of Adel shop practice. It contains information on the Inspection Department, types and practical uses of gages, inspection tools such as microme-

ters, depth-gage verniers, etc. It also gives general information on large machines used in the machine shop and in heat treating, plating and magnetic inspection of metals. This hand book is not intended to give practical working instruction, but rather to acquaint each worker with all the processes and labors involved in fabricating Adel products.

As an aid to general information and employee training, Adel maintains a library containing a complete supply of information on subjects regarding which employees may wish further knowledge, such as the latest text books, catalogues and current periodicals.

Adel, along with other war plants, has had to make rapid advancement in methods, new products and expansion to keep up with the demands of war production. An introduction to the syllabus furnished foremen classes outlines training objectives thus: "The better our general knowledge of plant operations, as well as special knowledge of our own particular job, the more perfect work and improved production will result."

Hamilton Whitfield Blower

(Continued from page 44)

tion in noise, as re-entry of air into the compressor usually is accompanied by high-frequency pulsations.

An ingenious reversing valve has been developed for the blower, and makes possible air delivery in the same direction for both directions of rotation. Such a reversing valve is required when the blower is to be used on a reversible engine. The valve is a simple, one-piece design and does not add materially to the space requirements of the blower.

Comparative noise and efficiency tests recently made on a Whitfield blower of 4000 cfm capacity and a standard three-lobe blower of a design approved by the Navy, of substantially the same capacity, are said to have shown the Whitfield to have from 10 to 15 per cent less slip, 5 per cent greater volumetric efficiency, and from 4 to 9 per cent greater over-all adiabatic efficiency. Both the intake and the discharge noises were decidedly less with the Whitfield blower. The Whitfield's advantage with respect to noise is said to increase rapidly with the delivery pressure. It has been found that in the conventional blower the greater part of the noise of operation is due to air already compressed re-entering the blower and striking the advancing abutments on the rotors. In the Whitfield the air inside the blower is raised to the discharge pressure before the delivery port is opened, hence there can be no re-entry of air.

An improved port design is now being developed with the object of insuring that the pressure inside the blower always will exactly equal the discharge pressure when the discharge port is opened. This improved blower will not operate on a true adiabatic, but on a mixed cycle. It is claimed that while with the true adiabatic cycle the proper pressure at port opening is obtained only at one particular speed, with the new cycle the pressure will be correct over the whole speed range.

Rubber Yield Good

Planted in this country for the first time this year, Russian dandelions have produced up to 5000 lb of roots per acre on an experimental sowing in Michigan, it is reported by Dr. V. R. Gardner, experiment station director. The roots yield 2 to 4 per cent rubber.



WHEREVER WHEELS TURN *there's need for Spencer Vacuum*

The wheels of industry are producing mountains of waste and acres of dust these days, with less idle time for cleaning and fewer men to do the work.

SAVE MEN . . . SAVE TIME . . . SAVE MATERIALS

Removes debris during working hours with smaller cleaning force.

Removes dust—underfoot or from walls, pipes and overhead.

Cleans machinery—inside and out, without scattering dust.

Reclaims valuable metals, powders, chemicals.

Improves working conditions—health, safety, fire, explosions.

Cleans finished goods, cartons, trucks and freight cars.

Ask for Bulletin 102 on Portables or 125 on Spencer Stationary Vacuum Cleaning Systems.

THE SPENCER TURBINE CO., HARTFORD, CONN.
PORTABLE CLEANERS $\frac{3}{4}$ to $7\frac{1}{2}$ H.P.; STATIONARY SYSTEMS UP TO 100 H.P.

SPENCER VACUUM



Shapes

OF THINGS TO COME

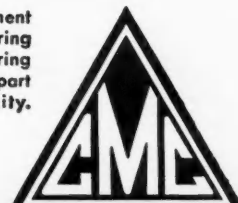
The shapes of tomorrow's products will differ from those of today. Materials will be different, too—new alloys and new plastics already point the way. Whatever those shapes, whatever the materials, Clearing Presses will be doing the job of giving form to the necessities and the luxuries to come because Clearing Presses will be built to do whatever the jobs of the future may demand.

Tradition has not limited Clearing designers up to now. Experience has proved what daring minds and determined hands can achieve, and Clearing will continue the leadership it has earned.

Shapes for things to come will mean new production problems. Cost will be a strong factor, with ever-closer tolerances the rule. Clearing performance today, and Clearing's record of past developments, is your assurance of able assistance in the future from the Clearing organization. Remember when they say it's an impossible job for a press: "Ask Clearing."

CLEARING MACHINE CORPORATION
6499 W. 65th St., Chicago, Illinois

When Boeing required press equipment they called upon Clearing engineering and production facilities. Clearing equipment now constitutes a vital part of Boeing's fabricating capacity.



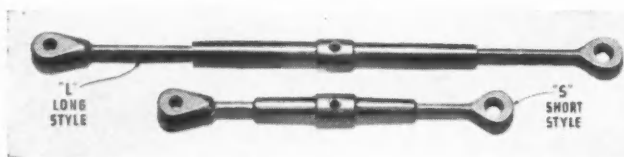
FOR SHAPES OF THINGS TO COME

CLEARING

M E C H A N I C A L E N G I N E E R I N G A N D P R O D U C T I O N

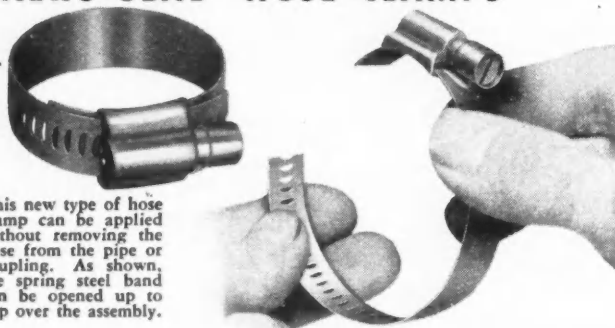


AIRCRAFT TURNBUCKLES



Made to Army-Navy specifications in regular assemblies known as Types AN130, AN135, AN140, and AC150 (designating specific combinations of cable eye, pin eye, and fork ends). Two styles are available, Long and Short, as shown in the picture above. Short styles in various sizes have tensile strength ratings from 800 to 4600 pounds, Long styles from 1600 to 17,500 pounds. Components may be ordered separately for ultimate combination on the manufacturer's final assembly line. Rigid quality control maintained throughout all manufacturing operations. Made on high production precision machinery, formerly used on commercial products.

"AERO-SEAL" HOSE CLAMPS



This new type of hose clamp can be applied without removing the hose from the pipe or coupling. As shown, the spring steel band can be opened up to slip over the assembly.

Extra-long take-up in the band gives maximum size coverage with a minimum number of clamp sizes. Uniform squeeze is obtained by a belt-like tightening action. Easy operation, with worm and worm gear action. Slotted head on screw has rim to prevent screwdriver from slipping. Design extremely compact. For hoses 1" diameter and larger. Quality construction throughout.



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Circulars on Aircraft Standard Parts products will be sent promptly on request, giving full engineering data and prices. Our products are backed by fifteen years' experience in this field.

1711 Nineteenth Ave.
Rockford, Illinois

**AIRCRAFT
STANDARD PARTS CO.**

Freight Transport by Air

(Continued from page 25)

domestic air carriers from the carriage of express during the same year. Taca's revenue from mail was some 5 per cent of its total; from passengers, 31 per cent.

The company concluded contracts with several chicle exporting companies, committing itself to transport all their inbound and outbound freight at a flat monthly rate. These agreements proved most satisfactory to all concerned; Taca was assured of a steady, dependable monthly income; the companies obtained vastly superior and less costly transportation for both inbound supplies and exports; and the government was able to collect a 7½ cents per lb export tax which it had previously lost through extensive smuggling operations into Mexico and British Honduras.

During 1937 Taca carried out 1,350,000 lb of chicle from the Petén District to Puerto Barrios. By 1939 this had increased to 2,159,000 lb, and in addition 2,326,300 lb were carried inbound. Diesel oil, for example, to run the powerplant of the electric-light works in Flores was flown by air from Puerto Barrios at 3 cents a lb. and lubricating oil at 5 cents a lb. Other material for the powerplant, if transported during the chicle season was at 3 cents a lb, and 5 cents a lb at other seasons.

Taca introduced the principle of deferred freight, at rates one-half or less than air express rates. The backlog of freight accumulated under this plan permitted the company to keep its planes loaded close to capacity on almost every run. This is how the so-called "butter-and-egg" run from Tegucigalpa to La Ceiba, on the Caribbean Coast, was developed.

Formerly the port town had to import most of its perishables from the United States. Now it gets garden truck grown in Honduras by airplane, from the fertile valleys beyond the coastal ranges. The inbound plane carries bales of merchandise, crates of hardware, sacks of cement, sheets of corrugated iron, and the same miscellany of goods to be found in any l.c.l. freight car. On the return journey it brings out native loaves of brown sugar wrapped in dried banana leaves, cans of lard, crates of eggs, bundles of dried meat, bound live poultry, tobacco, and similar valley produce.

Two of the largest gold mines of Nicaragua, the Neptune at Bonanza and La Luz at Siuna, are completely dependent on the transportation of their supplies by Taca from the Atlantic Coast and from Managua, where the greater part of U. S. shipments arrive. Taca originated the flying tanker by installing 600-gal tanks in the cabin to haul fuel oil needed to operate machinery at the mines. Its planes have carried flocks of sheep, lime, and almost every conceivable type of freight.

Two former Austrian and German pilots of the First World War established the earliest airline in South America, in 1920. This was the Sociedad Colombo-Alemana de Transportes Aereos, or "Scadta." For almost two decades it operated with marked success. Then in 1939 it was nationalized and merged with Saco, a small local Colombian airline, to form Aerovias Nacionales de Colombia, known as Avianca.

No small part of Scadta's success was due to its air cargo operations. The volume of cargo transported in Colombia during the past five years was close to 60 million pounds, almost twice that on U. S. domestic air carriers, and about three-fifths that of Taca during the same period.

As in Central America, the immense topographical obstacles presented to the development of surface transportation gave impetus to the growth of air cargo. In 1920 about 80 per cent of the commerce of Colombia moved along the route of the Magdalena River, between the Caribbean port of Barranquilla and the isolated mountain capital of Bogota. The journey by river steamer normally required 8 to 14 days during the rainy months, and in the dry season was subject to frequent lengthy interruption. Even the old single-engined, float-

type Junkers planes first employed changed this to a 7-hr trip.

From as early as 1922 Scadta paid cash dividends. The initial rate of 3 per cent was doubled in 1923 and doubled again in 1926. During the ten years preceding its nationalization in 1939, earnings were equivalent to a complete return of the original investment, while the initial equity was preserved and increased.

An average of more than half of the company's net revenue, however, came from sources other than transportation. During the Colombia-Peru War, for example, Scadta added to its revenues commissions paid by the government for the purchase of planes. From 1936 to 1939, the company made substantial profits out of aerial exploration and photographic work for all concerns. In addition, the company derived a considerable revenue from the sale of its own postage stamps, for which it paid the government a certain percentage. In 1940 Avianca's total stamp revenues amounted to over half a million U. S. dollars. There is even a profit from the sale of air-mail stamps to collectors.

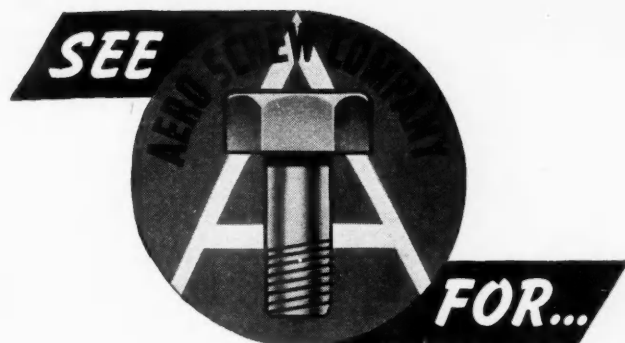
Scadta had large remunerative annual contracts with the Shell Company and other oil interests. Knocked-down autos, supplies, pipes, drilling equipment, and material of every kind were carried over the mountains to the llanos of eastern Colombia. In 1940, when the German personnel was separated from the reorganized company, two of the dismissed German pilots purchased some second-hand Beechcraft and obtained contracts with the Shell Oil and Richmond Petroleum companies to operate an unscheduled air freight service in the sparsely populated llanos under the corporate name of Arco. Avianca was eventually obliged to buy them out, at a good profit to the operators.

Another early operation, organized in 1925, was the Lloyd Aereo Boliviano in the land-locked republic of Bolivia. Its first operations were between Cochabamba and Santa Cruz, a 200-mile journey, which the planes shortened from four days to three hours. By 1938 LAB was flying close to half a million miles a year over 3000 route miles. Through the activities of the LAB, Bolivia is in the process of passing directly from the llama and the pack animal to the airplane as a major means of transportation. To an even greater degree than most South American countries, Bolivia is dependent on air transport. Broadly speaking, its territory is divided between a high plateau ranging from 12,000 to 14,000 ft above sea level, and a low, alluvial, tropical plain which is drained by the tributaries of the great Amazon and Paraguay River systems. Railway and highway communication between the plateau and the lowland is practically non-existent. Air travel remains, and for many decades will remain, the only feasible means of rapid transport for passengers, express and freight.

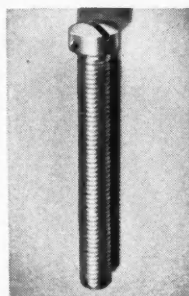
An interesting example of the contribution of the plane to the development of the continent is the transportation of mining freight by air. One of the first ventures of this kind was in 1933, to an old Peruvian gold mine known and producing in the days of the Incas, high up in the heart of the Andes.

The problem was to get modern equipment to the mine. Although only about 40 air miles from Cuzco (11,000 ft elevation) to the mine site at Huanacopampa on a plateau 12,800 ft high above the Apurimac Valley, the trip involved 10 days or more by muleback along narrow and dangerous trails. Transportation of large pieces of machinery was impossible under these conditions, and the cost of building a road was prohibitive.

Panagra undertook to solve the problem with Ford trimotors, and during 1933 and 1934 transported some 1,500,000 lb of mining machinery, including a complete milling, amalgamating, and cyaniding gold plant, a hydro-electric plant, and other equipment. From 1936 to 1938, Panagra also operated what was widely known as the "Tipuani Gold Special," to another ancient Incan mine on the eastern slopes of the Andes in Bolivia, which had been neglected for centuries because of transportation difficulties.

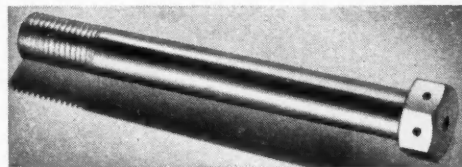


DRILLED FILLISTER HEAD MACHINE SCREWS



Used in many assembly operations and hence available in several types and a wide range of sizes. Low-carbon screws, for ordinary uses where high strength and close tolerances are not required, made to Air Force drawings AC500A and AC501A. Heat-treated nickel steel screws, for more particular applications where screws are appreciably stressed, conform to Army-Navy drawings AN502 and AC503. For close positions, where double cross-drilling is desirable, nickel steel screws conform to Navy drawing NAF-1164. Plating is bright and uniform. Nickel steel items identified by "X" on head.

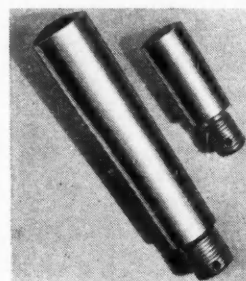
STEEL DRILLED HEAD AIRCRAFT BOLTS



Generally known as "Engine Bolts" and widely used in aircraft construction where bolts with heads drilled to accommodate lock wire are required.

Holes drilled through all faces to meet center hole in top of hexagon head. Made of heat-treated nickel steel to conform with Army-Navy specifications, in types AN73 through AN81 and sizes up to 6" length. Also in coarse thread (NC3) or fine thread (NF3) styles. Carefully inspected and tested for quality, accuracy, and uniformity. Cadmium plating conforms to AN-QQ-P-421. Identified by "X" on head.

THREADED TAPER PINS



Specially-designed pins, generally used in aircraft construction in place of commercial taper pins. Made to conform with Air Force drawing AC386 in sizes from 1 through 5. Can be furnished with threaded end either drilled or not drilled for cotter pin. Material is nickel steel of Army-Navy AN-QQ-S-629 specification, cadmium plated in accordance with AN-QQ-P-421. Centerless ground after hardening to insure accuracy and uniformity. Companion AN975 washers also available.

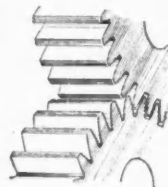
CATALOG AND ENGINEERING DATA

Send for your copy of new Catalog No. 101, showing complete prices and engineering data on Hexagon and Drilled Head Bolts, Clevis Bolts and Pins, Fillister and Washer Head Screws, and Threaded Taper Pins.



AERO SCREW COMPANY
19th Ave. at 12th St., Rockford, Illinois

SPEEDS WAR PRODUCTION EVERYWHERE



MACHINE PARTS ARE HARD TO GET

You can help make the machinery you now operate last much longer without trouble, delay and expense of repairs and replacements, by using Lubriplate lubricants.

Reports from industry everywhere are telling how Lubriplate lubricants are helping to prevent shut downs and repairs. Some of these stories are almost beyond belief.

Everyone engaged in war production owes it to his Government . . . owes it to himself . . . to see what Lubriplate lubricants will do to increase his production. Lubriplate is different. It is not to be compared with ordinary oils and greases. Lubriplate arrests progressive wear. It protects machine parts against rust and corrosion. It maintains a wear-resisting protective film on bearing surfaces. There are Lubriplate lubricants to meet all oper-

ating requirements, high and low temperatures, and in the presence of water and steam. Even under certain chemical conditions Lubriplate is performing in a manner that would be impossible with most conventional lubricants. Lubriplate outlasts ordinary lubricants many times, therefore it is extremely economical.

In these war days when production is vital and machine replacement parts are hard, or, impossible to get, Lubriplate lubricants will materially help keep machines running efficiently and at reduced power consumption. Write today for copy of "The Lubriplate Film" containing much valuable information.

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